2012 Chesterfield WaterTrends Report of the Quality of Select Streams, Rivers and Lakes in Chesterfield County, Virginia

The James River at Robious Landing Park (WaterTrends Station 1).

Chesterfield County
Department of Environmental Engineering
Water Quality Section

March 2013

Executive Summary

In 2012, volunteer monitors conducted water quality investigations at thirty-one stream and river stations and at two lake stations in Chesterfield County. There were 408 individual site visits conducted by 45 volunteer monitors, representing a total of 548.3 hours of effort. Fifteen new monitors joined the program in 2012. A basic suite of parameters measured at each site included pH, dissolved oxygen, water temperature and clarity. Water depth was recorded at fifteen stream and river reaches and at one lake site. Ambient air temperature was additionally noted at all sites. Nine sites incorporated monitoring for *E. coli* during 2012. Observations of general water conditions, water coloration, odors, debris present, plants and wildlife were also recorded.

As in past years, most all annual medians of pH, dissolved oxygen and surface water temperature did not violate Virginia Department of Environmental Quality (VADEQ) surface water standards during 2012. Exceptions to these observations included three annual or monitoring period medians where pH was below 6.0 units and one median where dissolved oxygen was below 4.0 mg/L. Details of these sites and observations are discussed in their respective sections.

Observations of pH indicated that most all measurements made during 2012 fell within the acceptable 6.0 to 9.0 unit range specified by the Virginia Department of Environmental Quality. There were 19 observations of low pH that fell below the VADEQ acceptable range. The majority of these measurements were noted within two stream systems in 2012 (Nuttree Branch; Station 5 and Second Branch; Stations 13/34). Both of these stream systems are currently on VADEQ's impaired waters list for pH impairments from natural sources. None of the low pH readings observed appeared to be pollution related and overall pH values among all sites were acceptable and similar to those observed during previous years.

Dissolved oxygen concentrations indicated adequate to well-oxygenated waters at most all sites during 2012. During the year, there were 31 individual median observations at ten reaches that did not meet the minimum 4.0 mg/L VADEQ standard for adequate oxygen. The majority of these low readings were limited to one or two observations during the year. Two sites at which persistent low dissolved oxygen concentrations were noted (Nuttree Branch; Station 5 and Winterpock Creek; Station 15) are on VADEQ's impaired waters list for dissolved oxygen impairment from natural sources. In general, the majority of the low dissolved oxygen concentrations noted among the sites monitored were typically noted during the growing season (April - October).

Monthly median temperatures and individual measurements varied normally according to season. There were three events recorded in 2012 where the water temperature equaled or exceeded the state standard of 32.0 degrees Celsius. These elevated temperatures were observed at the Swift Creek site at Bailey Bridge Road (Station 4) and at the Swift Creek site located within Pocahontas State Park (Station 35). In these three instances, the elevated instream temperatures were attributed to concurrent hot ambient air temperatures and were not related to any water quality concern.

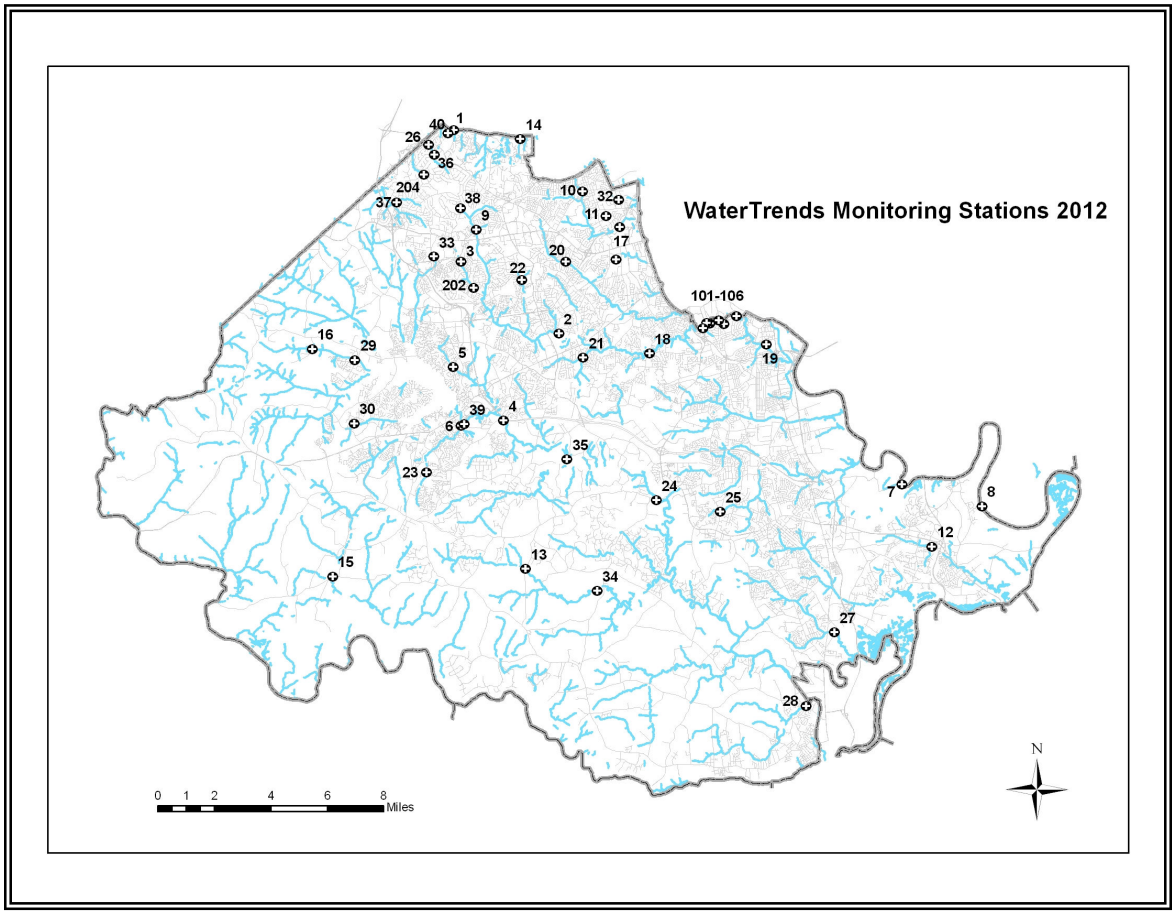
Water clarity was measured with a 120-centimeter turbidity tube (stream and river stations) or by a standard eight-inch Secchi disk at the James River at Enon Park and the Walton Lake stations. The greatest annual median transparencies (≥130.0 centimeters) were observed at ten sites (33%) during 2012. Substantially reduced clarity was again observed at Nuttree Branch (Station 5) where the annual median transparency was calculated as 13.0 centimeters, the lowest annual median transparency noted at all sites during 2012.

In 2012, *E. coli* monitoring using the Coliscan Easygel method conducted at nine sites to characterize ambient bacteria levels. The monitoring periods medians observed at these nine station ranged from <20 CFU/100ml at multiple reaches to 180 CFU/100ml. There were seven individual measurements made at four sites in 2012 that exceeded the 235 CFU/100ml VADEQ *E. coli* water quality standard for recreational contact. Of these four sites, only one, the James River at Enon Park, was currently listed on VADEQ's impaired waters list for bacterial impairment. Observations of bacterial contamination at the remaining three stations were isolated and returned to acceptable levels on subsequent surveys. There was no indication of active sewage discharges observed in 2012.

Surveys were conducted the most on sunny clear days and partly cloudy days during normal baseflow or calm conditions. As noted in past report the majority of the observations recorded in 2012 indicated a light to dark brown or green color present in the monitored waters. As in past years, odors were infrequently recorded and when noted they were usually described as "earthy". As in past reports, the most common "trash" item continued to be litter and leaves/debris from the watersheds. A variety of wildlife was observed during the year to include numerous aquatic insects, fish, frogs, turtles, songbirds and waterfowl.

Introduction

This report presents the water quality data collected by volunteer monitors in the Chesterfield WaterTrends Program. Historically, volunteers collected water quality monitoring data through separate programs coordinated by Chesterfield County's Department of Environmental Engineering - Water Quality Section and Friends of Chesterfield's Riverfront. The Chesterfield WaterTrends Program began in 2008 when these two separate elements were combined into one program jointly coordinated by the Water Quality Section and Friends of Chesterfield's Riverfront. In 2011, the Water Quality Section became the sole agency in the implementation and administration of WaterTrends and currently holds the VADEQ grant that funds the program. Chesterfield WaterTrends sites include streams, rivers and lakes. Monitors collect data on a volunteer basis to indicate a general state of water quality. The WaterTrends program is included as a monitoring and outreach component of Chesterfield County's VPDES Permit VA0088609 administered by the Department of Environmental Engineering - Water Quality Section.



Map 1. WaterTrends Volunteer Monitor Sites, 2012

Residents with an interest in health of their local water body were involved in the choosing of the Chesterfield WaterTrends sites. Reaches were selected in areas where primary contact with the surface water most likely could occur (areas with public access

and recreational opportunities). Chesterfield WaterTrends trainings are held at least two times per year in conjunction with a recertification session. Trainings in 2012 were offered in the winter, spring and fall. Monitors who received training were asked to commit to the program for a period of at least one year. After their first year in the program, monitors are required to attend an annual recertification session each subsequent year to keep their skills current. A total of thirty-one stream and river sites and two lakes were monitored regularly as part of the program in 2012. Nine of these sites were monitored for *E. coli* bacteria. Fifteen new monitors joined the program in 2012.

Methods

A Station ID was assigned to each Chesterfield WaterTrends site. All stream and river sites were assigned a single or double-digit number. All lake sites were given a triple digit number, where the first two digits represented the lake and the last digit denoted the site on the lake. As in past years, the sampling frequency for sites in the Chesterfield WaterTrends Program varied. Lake sites were sampled on a monthly basis at multiple stations during the growing season (approximately April – November) from docks or boats. Streams and rivers were monitored year round at varying frequencies. A core suite of parameters was measured at each site and included pH, dissolved oxygen, water temperature and turbidity. Water depth was recorded at lake sites and at several stream and river sites. Ambient air temperature was also noted. Observations of general water conditions, water color, odors, debris, plants and wildlife were recorded as part of the site visit.

Chesterfield WaterTrends volunteers used an armored Celsius thermometer to record water and air temperature. Dissolved oxygen was measured using a modified Winkler titration (LaMotte#5860) and pH was measured using a precision pH kit (LaMotte#5858). Turbidity was measured at lakes and most river sites using a standard eight-inch diameter Secchi disk. At most stream sites, a 120-centimeter turbidity tube was used to measure water clarity (turbidity). Trophic State Index values were calculated for lakes in the Chesterfield WaterTrends Program. Water depth was determined using the Secchi disk as a sounding line. In all instances when possible, duplicate measurements were made to verify readings. At nine sites, *E. coli* levels were determined using the Coliscan Easy-Gel Kit, a method using pre-treated Petri dishes mixed with pre-packaged media and one to five milliliters of sample to grow bacteria. Observed *E. coli* densities were expressed as Colony Forming Units per 100 milliliters (CFU/100ml).

Datasheets were completed in the field and entered into an electronic spreadsheet by each Chesterfield WaterTrends monitor. The electronic spreadsheets and datasheets were sent quarterly to the data coordinator. The spreadsheets were compiled and subjected to a quality control review performed by the Quality Control Officer. All data was then uploaded into the Department of Environmental Quality's Virginia Volunteer/Non-Agency Monitoring Database.

Station Descriptions and Data Summaries

The following pages describe each site and a summary of the data and observations made during 2012. Monthly and annual median values for each monitored parameter have been calculated and outlined in each site summary table when applicable. Associated maps depict the sampling station locations. Specific field data sheets for each site and monitoring survey are included in Appendix A.

Station ID: 1

Site: James River at Robious Landing Park

Latitude: 37.5591

Longitude: 77.6469

Watershed: James River

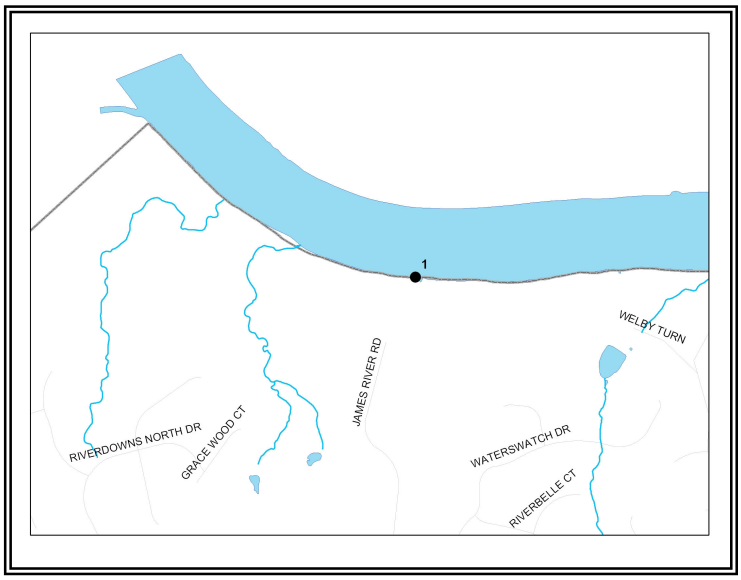
Land use: Mixed

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 18.0

Monitoring since: August 2001



This site is located on the James River in the northern portion of Chesterfield County within the Robious Landing county park. River measurements and water samples were obtained from the wooden boat dock at the park once per month. A total of 12 surveys were conducted during 2012.

Table 1-1. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml)
January	1	*	≥130.0	7.5	11.8	6.0	11.5	*
February	1	*	≥130.0	7.0	11.4	7.0	6.0	*
March	1	*	70.5	7.0	10.0	11.0	13.5	*
April	1	*	76.5	7.0	8.8	14.0	11.5	*
May	1	*	79.5	7.0	7.4	22.0	23.0	*
June	1	*	91.2	7.5	7.0	25.0	25.5	*
July	1	*	≥130.0	7.5	5.9	29.0	29.0	*
August	1	*	≥130.0	8.0	7.0	29.5	28.0	*
September	1	*	≥130.0	8.0	8.1	24.5	25.0	*
October	1	*	≥130.0	7.5	8.8	17.5	21.0	*
November	1	*	≥130.0	7.5	10.0	10.0	11.0	*
December	1	*	75.0	7.5	9.9	10.0	15.0	*
2012 Annual Median		*	≥130.0	7.5	8.8	15.8	18.0	*
2011 Annual Median		*	*120.0*	*7.5*	*9.2*	*17.5*	*20.5*	*
2010 Annual Median		*	*120.0*	*7.5*	*8.6*	*16.5*	*17.0*	*
2009 Annual Median		*	*92.0*	*7.5*	*7.8*	*15.5*	*22.0*	*
2008 Annual Median		*	*120.0*	*7.5*	*8.2*	*15.5*	*16.0*	*

Sampling of the James River at Robious Landing Park was conducted from January through December during 2012. Sampling occurred mostly on clear/sunny days or partly cloudy days (ten surveys) with overcast or shower conditions recorded on the remaining two site visits. Normal baseflow conditions were noted on nine dates, high/elevated flows on one visit and low flows on two occasions. Water color was recorded as "clear" on the majority of the surveys (nine) with "turbid" conditions present on the remaining three events. Leaves and debris were the most often recorded floatable in the water and

were noted on three occasions during 2012. The presence of algae was observed during September and October. No unusual odors were noted during 2012.

As in past years, water depth was not measured at this site. Monthly transparency values as measured by turbidity tube ranged from a low of 70.5 centimeters in March to over 130.0 centimeters on multiple occasions. The annual median transparency value (≥130.0 centimeters) was the greatest observed at this site to date and indicated a general increase in clarity. As noted during previous years' monitoring, all monthly pH values during 2012 were within the 6.0 - 9.0 unit standard range set by the Virginia Department of Environmental Quality (VADEQ). Additionally, no individual pH measurements violated the VADEQ standard during 2012. Monthly surface temperatures ranged from 6.0 to 29.5^{o}C and varied normally with season. No individual temperature values exceeded the VADEQ standard of 32.0^{o}C during 2012. All individual dissolved oxygen concentrations were above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. All observations in 2012 were indicative of continued excellent water quality at this site.

Station ID: 2

Site: Tributary to Falling Creek in Rockwood Park

Latitude: 37.4542

Longitude: 77.5804

Watershed: Falling Creek

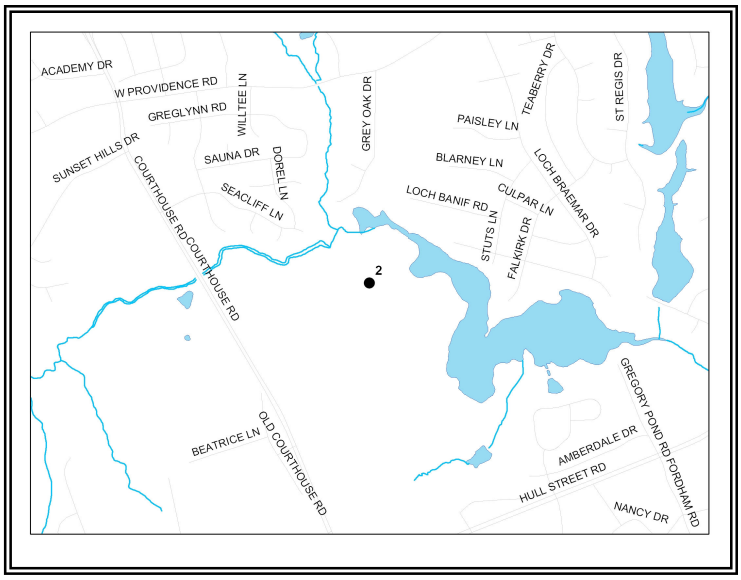
Land use: Residential, County Park

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 26.0

Monitoring since: August 2001



This site is located on an unnamed tributary to Falling Creek in the north central portion of Chesterfield County within Rockwood Park. Stream measurements and water samples were obtained from the wooden footbridge one quarter of a mile past the nature center once/twice per month from January to December. A total of 14 surveys were conducted during 2012.

Table 1-2. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	2	0.68	55.1	6.5	12.4	5.0	6.3	*
February	1	0.51	84.0	6.5	9.7	8.5	13.0	*
March	2	0.52	81.0	6.5	6.4	17.8	21.3	*
April	1	*	71.0	6.5	6.9	15.0	14.0	*
May	1	*	62.0	6.5	5.3	22.0	23.5	*
July	2	0.56	64.5	6.5	5.1	22.5	24.5	*
August	1	0.43	≥130.0	6.5	4.0	26.0	27.0	*
September	1	0.46	≥130.0	6.5	4.7	24.0	25.5	*
October	1	0.56	76.0	6.5	7.0	12.5	8.0	*
November	1	*	*	6.5	7.1	9.5	18.0	*
December	1	0.47	90.0	6.5	9.4	5.0	6.5	*
2012 Annual Median		0.52	72.0	6.5	6.9	16.3	19.5	*
2011 Annual Median		*0.65*	*66.0*	*6.5*	*9.3*	*7.5*	*11.0*	*
2010 Annual Median		*	*86.8*	*6.5*	*6.0*	*19.0*	*21.0*	*
2009 Annual Median		*	*118.0*	*6.5*	*8.1*	*12.0*	*17.5*	*
2008 Annual Median		*	*90.6*	*6.5*	*7.2*	*16.5*	*22.0*	*

Sampling of this tributary to Falling Creek was conducted during eleven months in 2012. Eight of the monitoring events occurred during clear and sunny days with partly cloudy or overcast days noted for the remaining five surveys. Normal baseflow conditions were noted on nine of the surveys with low flow conditions present on four visits during the latter part of the year. High water conditions were recorded during the July 15, 2012 survey resulting from antecedent rains. Water coloration was observed as varying shades

of brown or "turbid" during most of the sampling events. Leaves, debris and pollen were the most commonly observed floatables. The presence of trash was noted during the late January survey. As in previous years, there were no perceptible odors recorded for 2012.

Water depth was measured at this site on several occasions during 2012 with monthly values recorded as 0.43 to 0.68 meters. Monthly transparency values ranged from a low of 55.1 centimeters in January to over 130.0 centimeters during August and September. The annual median value (72.0 centimeters) was slightly greater than the 2011 annual median and was in the range of previously observed values. All monthly pH values during the year were within the 6.0 - 9.0 unit standard range set by VADEQ. Additionally, no individual pH measurements violated the VADEQ standard during 2012. As noted for the previous four years, measurements of pH did not vary month to month during 2012 indicating a relatively stable system. Monthly surface temperatures ranged from 5.0 to 26.0^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2012. All monthly median dissolved oxygen concentrations noted during 2012 were at or above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. During the site visit in August, the dissolved oxygen measurement was just at 4.0 mg/L, an observation often present during summer months when flows are lower and instream temperatures are greater. This observation was similar to that noted in past years at this site during summer. The annual median dissolved oxygen concentration (6.9 mg/L) was well above the 4.0 mg/L threshold indicating well-oxygenated waters. Water quality measurements at this site continue to suggest very good water quality.

Station ID: 3

Site: Tributary to Falling Creek at Midlothian Mines Park

Latitude: 37.4917

Longitude: 77.6429

Watershed: Falling Creek

Land use: Residential, Commercial, Park

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 22.0

Monitoring since: June 2008

This site is located on an unnamed tributary to Falling Creek in the north central portion of Chesterfield County within Midlothian Mines Park. Stream measurements and water samples were obtained from the stream located approximately 50 meters west of Groveton Terrace, once per month from February to December. A total of 11 surveys were conducted during 2012.

Table 1-3. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
February	1	*	78.0	6.5	10.2	8.0	9.5	<20
March	1	*	105.0	6.5	10.0	7.5	5.0	<20
April	1	*	101.0	6.5	5.9	14.0	12.5	<20
May	1	*	90.5	6.0	5.9	21.0	25.5	*
June	1	*	110.0	6.5	6.0	23.0	19.0	<20
July	1	*	70.0	6.5	4.7	30.0	29.0	20
August	1	*	65.0	6.5	4.3	24.5	23.5	<20
September	1	*	60.0	6.5	5.1	25.5	26.0	<20
October	1	*	65.0	6.5	3.7	20.0	23.0	<20
November	1	*	50.0	6.0	2.6	10.0	11.5	<20
December	1	*	15.0	6.5	2.1	8.0	10.0	<20
2012 Annual Median		*	70.0	6.5	5.1	20.0	19.0	<20
2011 Annual Median		*	*	*	*	*	*	*
2010 Annual Median		*	*73.6*	*7.0*	*7.6*	*16.0*	*20.0*	*
2009 Annual Median		*	*52.8*	*6.0*	*7.5*	*19.0*	*21.0*	*
2008 Annual Median		*	*42.4*	*6.0*	*7.0*	*20.3*	*21.5*	*

Sampling was conducted at the Tributary to Falling Creek site over eleven months during 2012. The majority (seven) of the sampling events occurred during clear/sunny or partly cloudy days with overcast days present on three occasions. Rain was present during the August sampling. Normal baseflow conditions were noted on eight surveys with low flow observations noted on three occasions during the latter part of the year (October -

December). Water coloration was typically recorded as varying shades of light brown with darker brown hues noted during the periods of lowest flow. Leaves and debris were noted six times and trash was present four times during 2012. There were no perceptible odors observed during 2012. Construction activities on a nearby pond was reported as complete in October.

As in past years, water depth was not measured at this site. Monthly transparency values as measured by turbidity tube ranged from a low of 15.0 centimeters in December to 110.0 centimeters in July. The annual median transparency value (70.0 centimeters) was the within the range of previously observed values. As noted during previous years' monitoring, all monthly pH values during the 2012 were within the 6.0 - 9.0 unit standard range set by the Virginia Department of Environmental Quality (VADEQ). Additionally, no individual pH measurements violated the VADEQ standard during 2012. Monthly surface temperatures ranged from 7.5 to 30.0^{o}C and varied normally with season. No individual temperature values exceeded the VADEQ standard of 32.0^{o}C during 2012. The dissolved oxygen concentrations observed in October, November and December were all below VADEQ's 4.0 mg/L limit and were indicative of poorly oxygenated waters. The annual median dissolved oxygen concentration was acceptable (5.1 mg/L).

E. coli measurements were made at this site for the first time in 2012 and were collected from February through December (no sample obtained in May). Samples were incubated for approximately 48 hours at 20^{o}C with resulting densities ranging from <20 – 20 CFU/100ml. No samples exceeded the 235 CFU/100ml VADEQ *E. coli* water quality standard for recreational contact.

Water quality measurements at this site continue to suggest good water quality.

Station ID: 4

Site: Swift Creek near Bailey Bridge Middle School

Latitude: 37.4098

Longitude: 77.6165

Watershed: Swift Creek

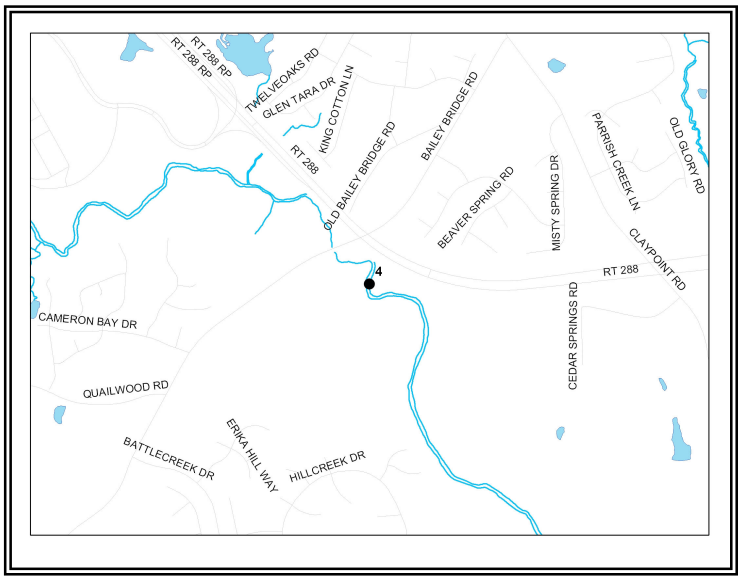
Land use: Residential, Commercial, School

Number of Stations: 1

Number of Monitors: 3

Volunteer Hours: 35.5

Monitoring since: August 2001



This site is located on the mainstem of Swift Creek, one of the major waterways of Chesterfield County. The site lies just downstream of the Swift Creek Reservoir in the central portion of Chesterfield County. Stream measurements and water samples were obtained from Swift Creek downhill from the Bailey Bridge Sewage Pump Station one to three times per month with a total of 18 surveys conducted during 2012.

Table 1-4. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	1	0.66	108.0	6.5	9.8	8.0	16.5	*
February	1	0.83	98.0	7.0	10.8	9.0	9.0	*
March	1	1.58	81.0	7.0	9.6	11.5	14.5	*
April	1	0.59	≥130.0	7.0	8.0	16.5	23.0	*
May	2	0.59	≥130.0	7.0	6.7	23.0	26.5	*
June	2	0.60	≥130.0	7.0	5.9	25.3	31.0	*
July	2	0.62	120.0	6.8	2.7	28.3	31.8	*
August	1	0.90	45.0	6.5	5.1	21.5	20.5	*
September	2	0.74	91.5	6.8	5.4	22.8	23.5	*
October	1	0.67	≥130.0	6.5	6.2	14.0	16.0	*
November	3	0.80	≥130.0	6.5	7.4	9.0	12.5	*
December	1	0.90	≥130.0	6.5	9.9	8.5	10.0	*
	2012 Annual Median	0.67	≥130.0	6.8	6.7	18.0	21.8	*
	2011 Annual Median	*0.61*	*≥130.0*	*6.8*	*7.3*	*13.8*	*16.0*	*
	2010 Annual Median	*0.61*	*≥130.0*	*6.5*	*6.2*	*19.0*	*19.0*	*
	2009 Annual Median	*	*≥130.0*	*6.5*	*6.0*	*21.0*	*27.0*	*
	2008 Annual Median	*0.56*	*94.0*	*7.0*	*7.0*	*19.0*	*23.0*	*

Sampling of this Swift Creek site was conducted multiple times over 12 months during 2012. The majority (twelve) of the sampling events occurred during clear/sunny or partly cloudy days with the remaining surveys (six) conducted during overcast days or periods of light rain. Normal baseflow conditions were noted on five surveys. High flows were noted during three events that followed antecedent rains (March, August and September). There were ten instances of low flow that were observed from May through July and

again during November and December. Water coloration ranged from clear with green/brown tinges to "turbid", usually in conjunction with the high flow observations. Leaves, debris and algae were noted occasionally during 2012. Aside from one instance of an "earthy" odor recorded during July, no perceptible odors were present during 2012. The construction activities on the bridge over Swift Creek that began in June the preceding year continued throughout 2012.

Water depth at this site ranged from 0.59 meters to 1.58 meters with an annual median value of 0.67 meters, the deepest observed to date. Monthly transparency values ranged from a low of 45.0 centimeters in August to over 130.0 centimeters on multiple occasions during the year. The annual median value (≥130.0 centimeters) was among the greatest observed at all sites in 2012 and was identical to the past three years' values. The transparency at this site was indicative of very clear waters. As noted for the previous three years, all monthly pH values during 2012, as well as individual measurements, were within the 6.0 - 9.0 unit standard range set by VADEQ. Monthly surface temperatures ranged from 8.0 to 32.0^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2012 although one measurement in July was at that threshold. Low individual dissolved oxygen concentrations were observed during July (2.7 mg/L), a similar time that low dissolved oxygen was noted the previous two years. All remaining individual dissolved oxygen concentrations and medians were at or above the VADEQ's 4.0 mg/L threshold. As noted in past reports, occasional low dissolved oxygen during summer months is common in streams, especially during periods of reduced flow and higher instream temperatures. Aside from the two individual instances of low oxygen content in the stream, all other observations were suggestive of excellent water quality at this site.

Station ID: 5

Site: Nuttree Branch in Brandermill

Latitude: 37.4517

Longitude: 77.6605

Watershed: Swift Creek

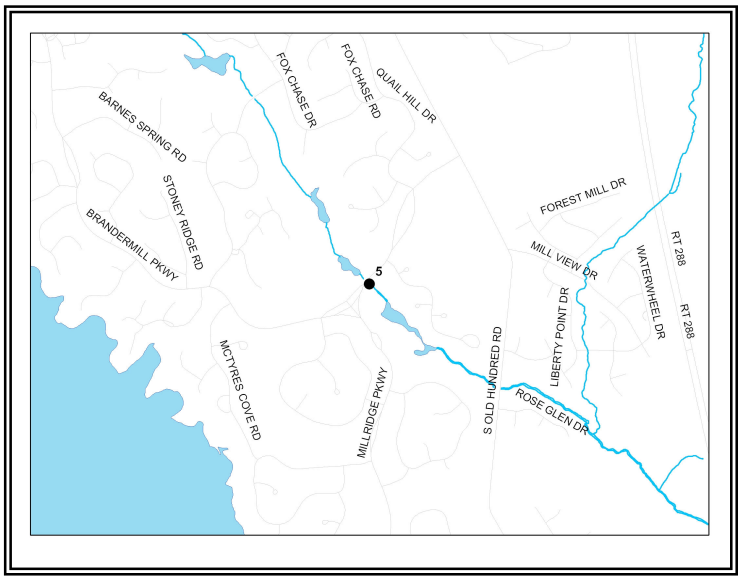
Land use: Residential, School

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 17.0

Monitoring since: April 2008



This site is located on Nuttree Branch in the west central area of Chesterfield County at Swift Creek Elementary School on Genito Road. Stream measurements and water samples were obtained one to four times per month from June through December near a small footbridge on a bike path accessed from the Brandermill Country Club. A total of 17 surveys were conducted during 2012.

Table 1-5. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
June	1	0.05	14.1	6.5	2.0	26.0	33.0	*
July	1	0.10	9.5	6.5	6.1	25.0	30.0	*
August	2	0.08	29.5	6.3	1.6	23.0	29.0	*
September	4	0.09	13.5	5.8	2.5	21.5	28.5	*
October	4	0.05	14.2	5.5	3.0	16.3	23.3	*
November	3	0.08	7.0	5.5	3.4	11.0	11.0	*
December	2	0.06	11.5	5.8	2.3	13.3	20.0	*
	2012 Annual Median	0.07	13.0	5.5	2.5	18.0	24.0	*
	2011 Annual Median	*	*36.4*	*6.5*	*6.3*	*18.5*	*18.0*	*
	2010 Annual Median	*	*55.8*	*6.5*	*7.7*	*22.0*	*22.3*	*
	2009 Annual Median	*	*51.0*	*6.5*	*8.4*	*20.2*	*20.5*	*
	2008 Annual Median	*	*56.0*	*6.5*	*7.0*	*22.5*	*24.0*	*

Sampling of Nuttree Branch was conducted seven months between June and December 2012. Eleven survey events occurred during clear/sunny and partly cloudy days and four three were conducted on overcast days or during periods of rain showers. Rain and storms were noted during two events (September 18 and October 2, 2012) in early autumn. Normal baseflow conditions were noted on five of the surveys. High flow observations were made on four occasion and low flows were noted on six surveys. As in the past year, water coloration was typically recorded as varying shades of brown with clear conditions noted four times. Leaves/debris and trash were observed in the reach

during the latter half of the year. A "rotten egg" or sewage odor and an earthy odor were noted on seven surveys beginning in late September.

Water depth in 2012 ranged from 0.05 meters to 0.10 meters with an annual median value of 0.07 meters and represented the first time this parameter was measured at this site. Monthly transparency values ranged from a low of 7.0 centimeters in November to 29.5 centimeters in August. The annual median value (13.0 centimeters) was the lowest observed to date and among all sites in 2012 and represented a continued loss of water clarity at this site. The transparency readings continued to remain reflective of relatively cloudy waters. Observed monthly median pH values indicated a general shift in pH toward a more acidic profile with four values (all <6.0 units) outside of the 6.0 - 9.0 unit standard range set by VADEQ. The annual median pH value (5.5 units) was the lowest observed at this site to date. Monthly surface temperatures ranged from 11.0 to 26.0^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2012. Most all (n=13) individual measurements of dissolved oxygen were lower than VADEQ's 4.0 mg/L limit and were indicative of poorly oxygenated waters. The annual median dissolved oxygen concentration was 2.5 mg/L, the lowest observed at this site to date and among all sites in 2012. The decrease in clarity, pH and dissolved oxygen at this site indicated a decline in water quality in 2012.

Station ID: 6

Site: Spring Run behind Birdsong Lane

Latitude: 37.4073

Longitude: 77.6441

Watershed: Swift Creek

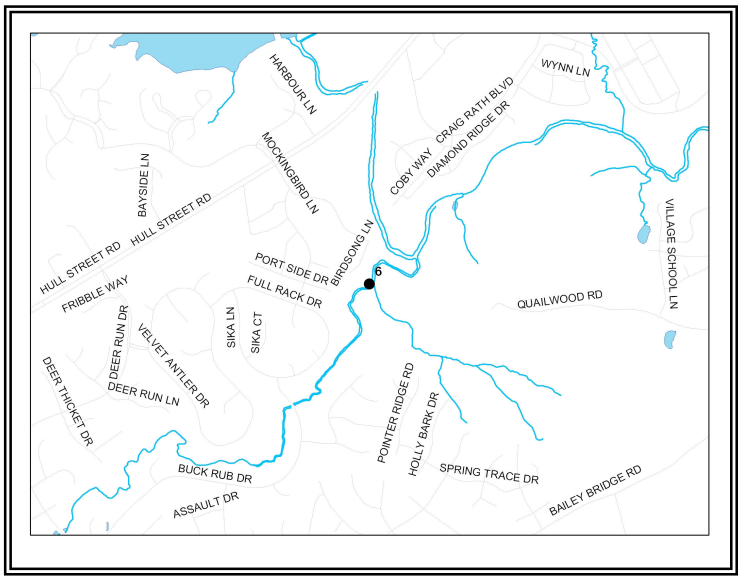
Land use: Residential

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 14.3

Monitoring since: April 2008



This site is located on Spring Run in the west central area of Chesterfield County at a private residence on Birdsong Lane within the Mockingbird Hills subdivision. Stream measurements and water samples were obtained one to three times per month from January through December. A total of 27 surveys were conducted during 2012.

Table 1-6. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	3	*	≥130.0	7.0	12.6	5.5	3.5	*
February	2	*	98.0	7.0	11.0	10.0	5.8	*
March	2	*	120.5	7.0	9.6	15.5	12.8	*
April	2	*	≥130.0	7.0	7.4	18.3	24.0	*
May	2	*	≥130.0	7.0	7.2	17.8	24.8	*
June	3	*	≥130.0	7.0	6.5	22.5	25.8	180
July	3	*	≥130.0	6.5	4.1	24.5	31.3	180
August	3	*	≥130.0	6.8	5.6	23.0	26.8	320
September	1	*	≥130.0	7.0	7.2	24.0	25.0	*
October	2	*	≥130.0	7.0	7.8	17.8	21.0	*
November	3	*	≥130.0	7.0	9.8	7.3	8.0	<20
December	1	*	≥130.0	7.0	10.9	6.0	9.0	*
2012 Annual Median		*	≥130.0	7.0	7.8	18.0	21.0	180
2011 Annual Median		*	*≥130.0*	*7.0*	*8.3*	*17.5*	*23.0*	*
2010 Annual Median		*	*≥130.0*	*7.0*	*8.4*	*15.8*	*18.8*	*
2009 Annual Median		*	*≥130.0*	*7.0*	*7.6*	*20.5*	*26.3*	*
2008 Annual Median		*	*≥130.0*	*7.0*	*7.2*	*18.5*	*23.0*	*

Sampling of Spring Run was conducted from January through December of 2012 with multiple visits each month. Water quality and categorical measurements were not made during four of the visits that were conducted specifically for the collection of *E. coli* samples in 2012. Clear/sunny and partly cloudy days were noted on nineteen of the sampling events. Overcast conditions or days with showers were recorded for four surveys. Normal baseflow conditions were noted on most all of the surveys (15) with only six low flow events and two high flow events observed. Clear water was observed on all but one (March 10, 2012) survey event during 2012. As in past years, no

perceptible odors were recorded during 2012. Leaves and debris were noted on the May 5, 2012 survey and algae growth was observed on August 8, 2012.

As in previous years, water depth was not measured at this site during 2012. Monthly transparency values ranged from a low of 98.0 centimeters in February to over 130.0 centimeters on the majority of the remaining months. As noted in prior reports, the annual median value (≥130.0 centimeters) was among the greatest observed at all sites and was characteristic of a continued high degree of water clarity. Most all monthly pH values during the year, in addition to the annual median, were similar (7.0 units) and were well within the 6.0 - 9.0 unit standard range set by VADEQ. Measurements of pH did not vary substantially month to month during 2012 and the annual median was identical to the past four years, all indicating a very stable system. Monthly surface temperatures ranged from 5.5 in January to 24.5^{o}C in July and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2012. All individual dissolved oxygen concentrations, and consequently all monthly values and the annual median, continued to be well above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. Monthly median values ranged from 4.1 to 12.6 mg/L with the annual median measured at 7.8 mg/L during 2012.

E. coli measurements were made at this site for the first time in 2012 and were collected on four occasions from June through November. Samples were incubated for approximately 24 hours at 35^{o}C with resulting densities ranging from <20 – 320 CFU/100ml. The August sample was the only instance at this site in 2012 where the density exceeded the 235 CFU/100ml VADEQ *E. coli* water quality standard for recreational contact.

All together, the observations made were characteristic of continuing excellent water quality at this site.

Station ID: 8

Site: James River near Enon

Latitude: 37.3631

Longitude: 77.3091

Watershed: James River

Land use: Mixed

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 44.0

Monitoring since: August 2001

This site is located on the James River in the eastern portion of Chesterfield County within the Mount Blanco subdivision. River measurements and water samples were obtained from a private dock located on Mount Blanco Road one to three times per month. A total of 21 surveys were conducted during 2012.

Table 1-7. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Secchi Depth (m)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	2	1.25	0.55	7.0	12.1	7.0	6.3	100
February	1	1.00	0.80	7.5	10.7	10.5	12.0	<20
March	3	1.80	0.40	7.5	9.7	16.5	19.0	40
April	2	1.95	0.70	7.0	9.0	16.5	18.0	110
May	1	1.30	0.60	7.5	9.1	23.5	27.0	300
June	2	1.60	0.40	8.0	7.6	29.5	29.0	4000
July	2	1.70	0.50	7.8	6.6	31.3	30.0	*
August	2	2.10	0.55	7.5	5.9	29.3	26.5	*
September	2	1.95	0.45	7.5	7.3	24.0	22.5	*
October	1	2.00	0.50	8.0	9.4	18.5	19.0	140
November	2	1.75	0.70	7.5	9.6	10.8	9.5	220
December	1	1.40	0.60	7.5	9.3	11.5	12.5	*
	2012 Annual Median	1.70	0.60	7.5	9.1	18.5	19.0	140
	2011 Annual Median	*1.80*	*0.50*	*7.5*	*9.1*	*21.8*	*22.8*	*
	2010 Annual Median	*1.90*	*0.60*	*7.5*	*9.0*	*19.3*	*20.0*	*
	2009 Annual Median	*2.10*	*0.60*	*7.5*	*9.1*	*18.0*	*20.5*	*
	2008 Annual Median	*2.00*	*0.60*	*7.5*	*8.6*	*19.0*	*21.0*	*

Sampling of the James River at the Enon site was conducted from January through December of 2012. Seventeen sampling events occurred on clear/sunny or partly cloudy days and four were conducted during overcast conditions. Normal baseflow conditions were noted on all twenty-one of the monitoring events in 2012. As in past reports, light brown was the most often recorded color during 2012 with twenty observations. Clear water was noted on one occasion during February. Leaves and debris were recorded on six surveys during March, June, September and November. Aside from an "earthy" odor recorded in July, no perceptible odors were noted during 2012.

Monthly median water depth at this station ranged from 1.00 meters in February to 2.10 meters in August. The annual median water depth was 1.70 meters, the lowest observed to date. As in past years, a Secchi disk was used at this site to measure the clarity of the river. Monthly median Secchi disk transparency values ranged from a low of 0.40 meters in March and June to a high of 0.80 meters in February. The annual median Secchi disk transparency value (0.60 meters) was similar to past reports. All individual measurements and monthly median pH values during the year were within the 6.0 - 9.0 unit standard range set by VADEQ. The annual median pH value (7.5 units) was identical to that of the past four years indicating stability. Monthly median surface temperatures ranged from 7.0 to 31.3^{o}C and varied normally with season. All individual dissolved oxygen concentrations and monthly medians were above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. The annual median dissolved oxygen concentration (9.1 mg/L) was in the range of previously observed values and identical to the previous year's measurement.

Eleven *E. coli* measurements were made at this site from January through December 2012. Samples were incubated for approximately 48 hours at 32^{o}C with resulting densities ranging from <20 – 4000 CFU/100ml. Three samples (May, June and late November) exceeded the 235 CFU/100ml VADEQ *E. coli* water quality standard for recreational contact.

All of the observations at this station continued to be suggestive of generally good water quality.

Station ID: 10

Site: Tributary to Powhite Creek at Bon Air Elementary School

Latitude: 37.5271

Longitude: 77.5643

Watershed: Powhite Creek

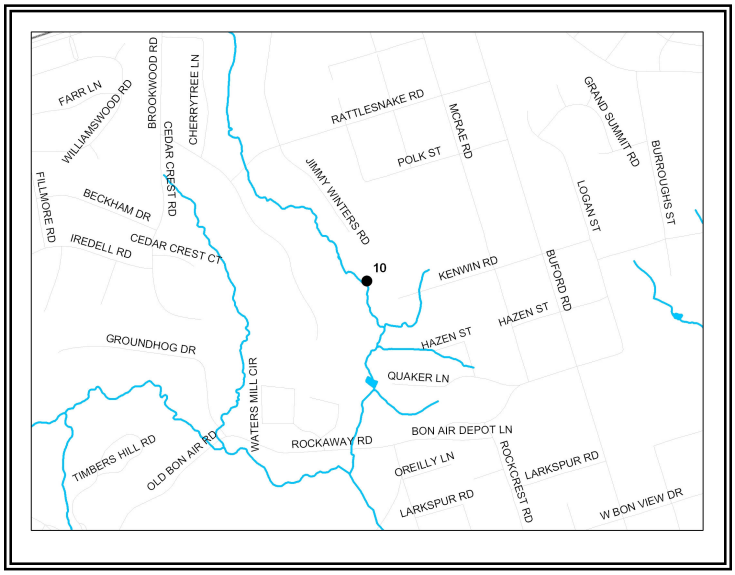
Land use: Residential, School

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 27.5

Monitoring since: July 2010



This site is located on a tributary to Powhite Creek in the northeastern area of Chesterfield County at Bon Air Elementary School. Stream measurements and water samples were obtained once per month from January to December with a total of 12 surveys conducted during 2012.

Table 1-8. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	1	*	≥130.0	6.5	10.4	4.5	4.0	*
February	1	*	≥130.0	6.8	10.1	8.5	10.0	*
March	1	*	≥130.0	6.8	8.9	18.5	23.5	*
April	1	*	≥130.0	6.5	8.1	14.5	17.5	*
May	1	*	≥130.0	6.5	6.6	19.0	21.0	100
June	1	*	≥130.0	6.5	5.6	20.5	25.0	520
July	1	*	≥130.0	6.5	4.6	23.0	24.5	180
August	1	*	≥130.0	6.5	4.9	22.5	24.0	180
September	1	*	≥130.0	6.5	7.4	16.0	20.0	140
October	1	*	≥130.0	6.5	7.5	12.5	17.5	140
November	1	*	≥130.0	6.5	9.0	7.0	8.0	160
December	1	*	≥130.0	6.5	9.4	8.0	12.5	200
2012 Annual Median		*	≥130.0	6.5	7.8	15.3	18.8	170
2011 Annual Median		*	*≥130.0*	*6.5*	*7.2*	*14.0*	*17.0*	*
2010 Annual Median		*	*88.1*	*6.0*	*6.6*	*18.5*	*26.7*	*

Sampling of this tributary to Powhite Creek was conducted from January through December of 2012. Seven survey events occurred during clear/sunny or partly cloudy days and five were conducted during overcast conditions or periods of showers. Normal baseflow conditions were recorded for six of the surveys and low flow conditions during two (June and October). Elevated flows were noted during April following antecedent and present rain showers. Water coloration was recorded as clear on all but one occasion (December; light brown). As in past reports, trash, leaves and debris were observed

during all twelve visits. There were no perceptible odors recorded for 2012. Fish, tadpoles and frogs were noted in the stream during the summer and fall surveys.

As in previous years, water depth was not measured at this site during 2012. All monthly and consequently the annual median transparency values were ≥130.0 centimeters indicating a high degree of water clarity. All monthly pH values during the year, as well as the annual median value, were within the 6.0 - 9.0 unit standard range set by VADEQ. Monthly surface temperatures ranged from 4.5 to 23.0^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2012. All monthly dissolved oxygen concentrations and consequently the annual median (7.8 mg/L) were above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters.

Eight *E. coli* measurements were made at this site from May through December 2012. Samples were incubated for approximately 48 hours at 22^{o}C with resulting densities ranging from 100 – 520 CFU/100ml. Only one sample (June) exceeded the 235 CFU/100ml VADEQ *E. coli* water quality standard for recreational contact.

All observations made during 2011 suggested excellent water quality at this site.

Station ID: 11

Site: Tributary to Powhite Creek at Poplar Hollow Trail

Latitude: 37.5142

Longitude: 77.5493

Watershed: Powhite Creek

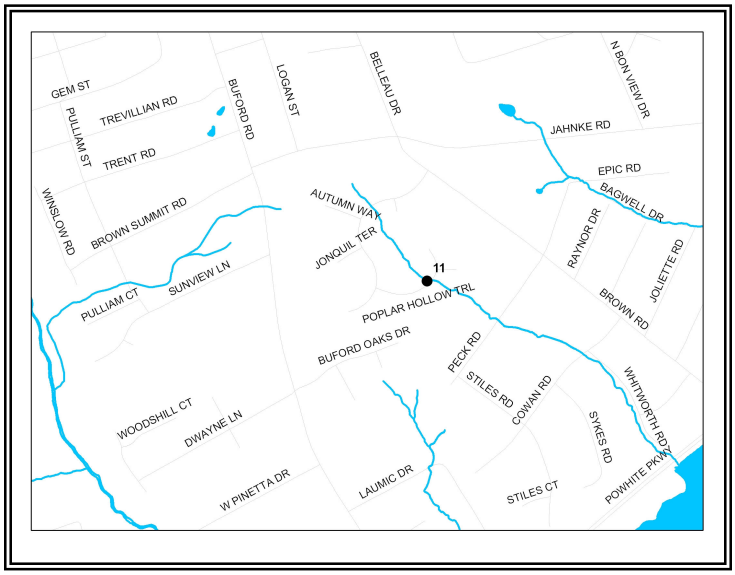
Land use: Residential

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 13.0

Monitoring since: January 2010



This site is located on a tributary to Powhite Creek in the northeastern area of Chesterfield County. Stream measurements and water samples were obtained approximately one to three times per month from February through December just north of the culvert running under Poplar Hollow Trail in the Spring Grove subdivision. A total of 15 surveys were conducted during 2012.

Table 1-9. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
February	2	0.10	≥130.0	6.0	10.2	10.0	15.0	<20
March	3	0.11	*	6.0	9.4	16.5	26.0	45
April	1	*	*	*	*	*	*	<20
May	2	0.09	105.0	6.0	7.5	19.5	30.0	<20
June	1	0.08	≥130.0	6.0	9.3	19.0	26.0	120
July	2	0.06	30.0	6.8	9.4	26.0	34.8	*
August	1	0.10	≥130.0	6.5	8.2	24.0	30.0	*
September	1	0.11	*	6.5	9.4	21.5	23.0	*
November	1	0.17	≥130.0	6.5	9.5	11.0	12.0	40
December	1	0.21	115.0	6.0	8.9	10.0	15.0	20
2012 Annual Median		0.10	122.5	6.0	9.4	19.3	26.0	<20
2011 Annual Median		*0.19*	*≥130.0*	*6.0*	*9.1*	*14.5*	*17.8*	*
2010 Annual Median		*0.25*	*≥130.0*	*6.0*	*8.7*	*15.5*	*22.0*	*

Sampling of this Tributary to Powhite Creek was conducted from January through December of 2012. Water quality and categorical measurements were not made during five of the visits that were conducted specifically for the collection of *E. coli* samples in 2012. Clear/sunny or partly cloudy conditions were recorded on nine of the survey events during 2012. Overcast conditions were noted on the May 5, 2012 visit. Normal baseflow conditions were recorded on five of the surveys and low flows were observed during an additional five visits, most often during the spring and summer. Clear water conditions were observed on eight surveys and turbid/light brown waters on two during

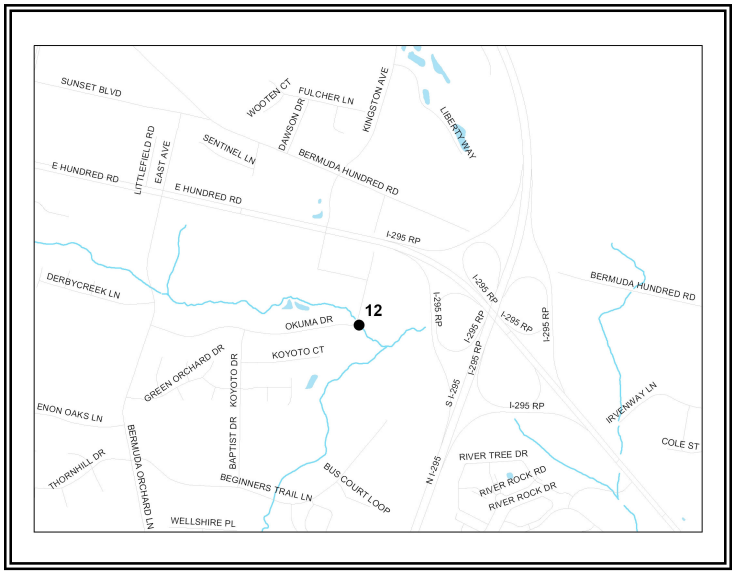
2012. Leaves/debris and algae were frequently noted. Aside from a slight "earthy" odor noted in June, no perceptible odors were observed during 2012. As in past years, water striders and large tadpoles were among the wildlife recorded at this site. Repairs to the road culvert were noted during the June survey.

Water depth at this site ranged from 0.06 meters in July to 0.21 meters in December. The annual median depth for the sampling area was 0.10 meters, less than the 0.19 meters observed in 2011. Monthly transparency values ranged from a low of 30.0 centimeters in July to over 130.0 centimeters on multiple occasions during the year. While the annual median value (122.5 centimeters) was lowest observed at this site to date, it was still indicative of very clear waters. All monthly pH values during the year, as well as the annual median (6.0 units) were within the 6.0 - 9.0 unit standard range set by VADEQ. The annual median value was identical to the previous two years measurements. Monthly median surface temperatures ranged from 10.0 to 26.0^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2012. All monthly dissolved oxygen concentrations were well above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. The annual median value for dissolved oxygen (9.4 mg/L) was slightly higher than observed for the past two years.

Ten *E. coli* measurements were made at this site from February through December 2012. Samples were incubated for approximately 72 hours at 23^{o}C with all resulting densities ranging from <20 to 120 CFU/100ml. None of the samples exceeded the 235 CFU/100ml VADEQ *E. coli* water quality standard for recreational contact.

All of the observations at this station were suggestive of continued excellent water quality.

Station ID: 12



Site: Johnson Creek at Kingston Avenue

Latitude: 37.3427

Longitude: 77.3416

Watershed: Appomattox River

Land use: Residential, Commercial

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 24.4

Monitoring since: January 2011

This site is located on the mainstem of Johnson Creek in the eastern area of Chesterfield County near its crossing with Kingston Avenue. Stream measurements and water samples were obtained on a monthly basis beginning in January, just east of the culvert on the north bank of the stream. A total of 12 surveys were conducted during 2012.

Table 1-10. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml)
January	1	*	≥130.0	6.0	10.0	8.5	10.5	*
February	1	*	≥130.0	6.0	9.1	5.0	22.0	*
March	1	*	118.0	6.0	6.7	17.0	23.5	*
April	1	*	112.0	6.0	6.7	17.0	21.5	*
May	1	*	102.0	6.0	6.3	19.5	28.5	*
June	1	*	97.0	6.0	6.6	20.5	26.0	*
July	1	*	86.0	6.0	7.1	25.5	34.0	*
August	1	*	78.0	6.0	7.2	23.5	28.0	*
September	1	*	≥130.0	6.0	7.6	17.5	24.5	*
October	1	0.05	110.0	6.0	7.8	19.0	28.0	*
November	1	0.53	104.0	6.0	7.9	13.5	14.5	*
December	1	0.46	98.0	5.5	8.9	9.0	11.5	*
2012 Annual Median		0.46	107.0	6.0	7.4	17.3	24.0	*
2011 Annual Median		*	*92.0*	*6.0*	*6.1*	*16.0*	*23.0*	*

Sampling of Johnson Creek was conducted once per month from January through December of 2012. Ten survey events occurred during clear/sunny or partly cloudy days and two were conducted on overcast days. Normal baseflow conditions were noted on eight of the surveys and a low flow condition was present during the June site visit. There were three instances of high flows recorded in March, April and June. Water coloration was recorded as varying shades of brown. Leaves and debris were observed

during the first four and last three months of the year. "Earthy" odors were noted on all twelve surveys.

Water depth was measured at this site starting in October 2012 with values ranging from 0.05 to 0.46 meters. Monthly transparency values ranged from a low of 78.0 centimeters in August to greater than 130 centimeters during January, February and September. The annual median value for transparency was 107.0 centimeters, slightly higher than the previous year's measurement. With the exception of December (5.5 units) all monthly pH values during the year, as well as the annual median (6.0 units), were within the 6.0 - 9.0 unit standard range set by VADEQ. Monthly median surface temperatures ranged from 5.0 to 25.5^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2012. Monthly dissolved oxygen concentrations ranged from 6.3 mg/L in May to 10.0 mg/L in January with all monthly dissolved oxygen concentrations well above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. The annual median value for dissolved oxygen was 7.4 mg/L. All of the observations at this station were suggestive of excellent water quality.

Station ID: 13

Site: Second Branch at Bundle Road

Latitude: 37.3336

Longitude: 77.6032

Watershed: Swift Creek

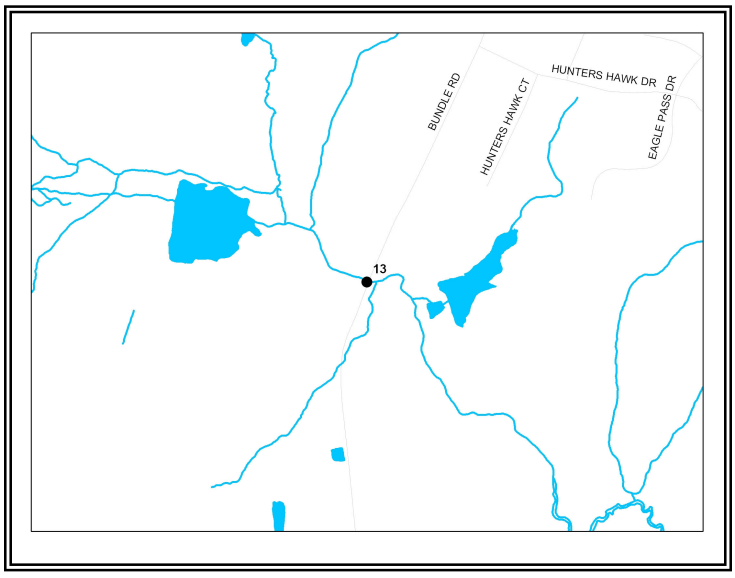
Land use: Rural Residential

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 7.5

Monitoring since: April 2010



This site is located on Second Branch in the south central area of Chesterfield County at its crossing with Bundle Road. Stream measurements and water samples were obtained on a monthly basis beginning in October, approximately ten feet upstream of the bridge along the north bank. Three surveys were conducted during 2012.

Table 1-11. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
October	1	*	82.5	7.0	6.2	12.0	20.5	*
November	1	*	80.8	5.5	6.2	8.0	18.0	*
December	1	*	75.2	5.5	6.5	*	*	*
2012 Annual Median		*	80.8	5.5	6.2	10.0	19.3	*
2011 Annual Median		*	*70.2*	*6.0*	*5.3*	*25.1*	*27.5*	*
2010 Annual Median		*	*51.2*	*6.0*	*4.1*	*23.0*	*25.0*	*

Sampling of Second Branch was conducted on three occasions during 2012. The October and November visits took place during clear/sunny conditions and the December survey was conducted on an overcast day. Normal baseflow conditions were noted on two of the surveys with a high flow observation present in December. Water coloration was typically recorded as varying shades of brown during all visits. Leaves and debris were observed during all site visits. As in the previous year, no perceptible odors were noted during 2012.

As in previous years, water depth was not measured at this site during 2012. Monthly transparency values ranged from a low of 75.2 centimeters in December to 82.5 centimeters in October. The annual median value (80.8 centimeters) was a slight improvement from past observations and represented a slight increase in clarity. Both the November and December pH values as well as the annual median (5.5 units), were slightly below the 6.0 unit threshold set by VADEQ. Monthly surface temperatures

ranged from less than 8.0 to 12.0^{o}C, varying normally with month. As in the previous year, no individual values exceeded the VADEQ standard of 32.0^{o}C during 2012. Monthly dissolved oxygen concentrations ranged from 6.2 mg/L in October and November to 6.5 mg/L in December with an annual median value observed at 6.2 mg/L. The limited sampling results at this site in 2012 suggest that the improved transparency values, lower pH readings and acceptable dissolved oxygen measurement indicate continued fair water quality.

Station ID: 14

Site: Tributary to the James River at Old Gun Road

Latitude: 37.5543

Longitude: 77.6040

Watershed: James River

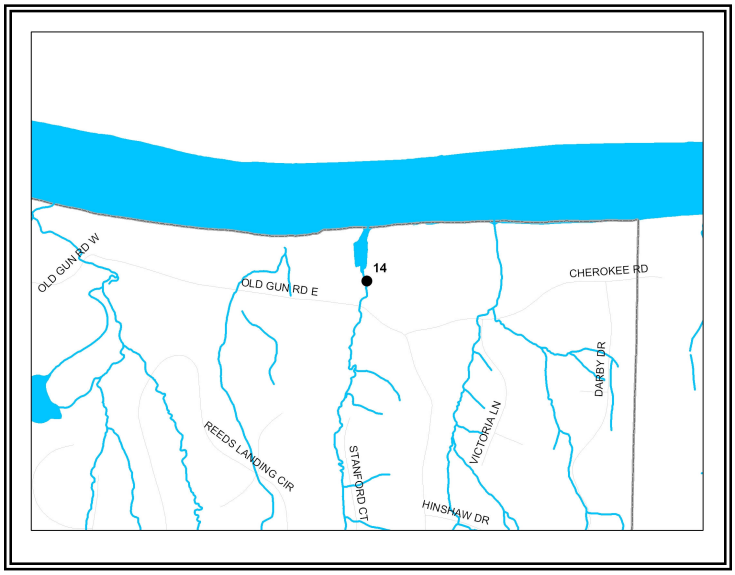
Land use: Residential

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 24.0

Monitoring since: January 2010



This site is located on a small tributary draining directly to the James River in the northern area of Chesterfield County. Stream measurements and water samples were obtained on a monthly basis immediately upstream of the boat slips at the Virginia Powerboat Association property. Twelve surveys were conducted during 2012.

Table 1-12. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	1	*	120.0	7.0	11.2	4.0	4.0	*
February	1	*	120.0	7.0	11.1	7.0	12.0	*
March	1	*	120.0	6.5	8.0	14.0	21.0	*
April	1	*	120.0	6.8	9.5	14.0	21.0	*
May	1	*	78.0	7.0	7.3	21.0	25.0	*
June	1	*	120.0	7.0	7.9	24.0	25.0	*
July	1	*	120.0	7.0	4.7	31.0	29.0	*
August	1	*	120.0	7.0	8.1	24.0	26.0	*
September	1	*	120.0	7.0	6.3	19.0	24.0	*
October	1	*	120.0	7.0	8.0	15.0	20.0	*
November	1	*	120.0	7.0	8.8	9.0	12.0	*
December	1	*	120.0	6.8	9.2	11.0	16.5	*
2012 Annual Median			120.0	7.0	8.0	14.5	21.0	
2011 Annual Median		*	*≥130.0*	*7.0*	*8.8*	*10.0*	*13.0*	*
2010 Annual Median		*	*≥130.0*	*7.0*	*7.5*	*17.0*	*16.0*	*

Sampling of this tributary to the James River was conducted from January through December of 2012. Nine survey events occurred during clear/sunny or partly cloudy days and three were conducted on overcast days. Normal baseflow conditions were noted on seven of the surveys and low flows were observed on four occasions during the latter half of the year. A flooded condition was observed during the May visit. Clear waters were present on all occasion except two where light brown hues were recorded. Foam, algae, leaves and debris were noted frequently from July through December. As in 2011, aside from an "earthy" odor recorded in March, no other perceptible odors were observed

during 2012. It was reported that an aquatic plant tentatively identified as *Hydrilla* clogged the creek's confluence with the river during August.

As in previous years, water depth was not measured at this site during 2012. Monthly transparency values ranged from a low of 78.0 centimeters in May to 120.0 centimeters on the remaining 11 occasions during 2012. Once again, the annual median value (120.0 centimeters) continued to indicate a high degree of water clarity. All monthly pH values during the year, as well as the annual median (7.0 units), were within the 6.0 - 9.0 unit standard range set by VADEQ. Measurements of pH did not vary at all month to month during 2012 (all values = 6.5 - 7.0 units), indicating a stable system. Monthly median surface temperatures ranged from 4.0 to 31.0^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2012. All monthly dissolved oxygen concentrations and consequently the annual median (8.0 mg/L) were above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. All of the observations at this station continued to suggest excellent water quality.

Station ID: 15

Site: Winterpock Creek at River Road

Latitude: 37.3306

Longitude: 77.7275

Watershed: Appomattox River

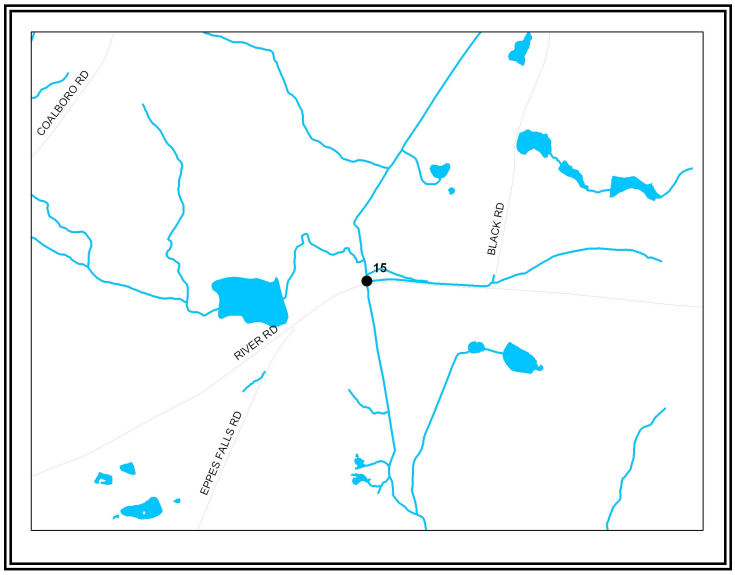
Land use: Rural Residential

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 17.0

Monitoring since: January 2010



This site is located on Winterpock Creek in the southwestern area of Chesterfield County at its crossing with River Road. Stream measurements and water samples were obtained once/twice a month approximately six meters upstream of the bridge. A total of 12 surveys were conducted during 2012.

Table 1-13. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	1	*	115.0	*	9.1	5.0	11.0	*
February	1	*	97.0	6.0	8.8	11.5	20.0	*
March	1	*	85.0	6.5	9.7	8.0	5.0	*
May	1	*	65.0	6.0	5.7	24.0	29.0	*
June	1	*	52.0	7.0	4.0	*	27.0	40
July	1	*	47.0	7.0	3.1	25.0	23.0	<20
August	2	*	57.0	6.8	3.0	24.5	30.5	<20
October	2	*	46.0	6.5	3.0	20.0	25.5	<20
November	2	*	46.5	6.0	4.9	5.5	9.3	<20
2012 Annual Median		*	57.0	6.5	4.7	15.8	23.0	<20
2011 Annual Median		*	*75.5*	*6.0*	*5.7*	*14.5*	*20.5*	*
2010 Annual Median		*	*65.3*	*6.5*	*6.4*	*19.0*	*24.1*	*

Sampling of Winterpock Creek was conducted once or twice a month between January through November of 2012. Nine survey events occurred during clear/sunny or partly cloudy days and two were conducted on overcast days. Normal baseflow conditions were noted on six of the surveys and low flows were observed on six occasions beginning in July. Water coloration was typically recorded as turbid or light brown with one notation of a clear condition recorded in January. Leaves/debris were recorded in August and November. For the third consecutive year, no perceptible odors were recorded during 2012.

As in the previous year, water depth was not measured at this site during 2012. Monthly median transparency values ranged from a low of 46.0 centimeters in October to 115.0 centimeters during January. The annual median value (57.0 centimeters) was the lowest observed at this site to date and indicated a reduction in water clarity. All monthly pH values during the year, as well as the annual median (6.5 units), were within the 6.0 - 9.0 unit standard range set by VADEQ. Monthly surface temperature measurements ranged from 5.0 to 25.0^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2012. Monthly dissolved oxygen concentrations ranged from 3.0 mg/L in August and October to 9.1 mg/L in January. Similar to the previous year, there were four instances where dissolved oxygen concentrations fell below VADEQ's 4.0 mg/L limit during 2012 (July through October). It is not uncommon for low dissolved oxygen to be present during the summer and often into the fall when flows are sluggish and water temperatures are elevated. Additionally, Winterpock Creek has been listed on the VADEQ impaired waters list since 1994 for low dissolved oxygen. The most recent impaired waters list has characterized the low dissolved oxygen as "naturally occurring".

Five *E. coli* measurements were made at this site from June through November 2012. Samples were incubated for approximately 24 hours at 35^{o}C with all resulting densities ranging from <20 to 40 CFU/100ml. None of the samples exceeded the 235 CFU/100ml VADEQ *E. coli* water quality standard for recreational contact.

The lower transparency and frequency of low dissolved oxygen at this site suggest continued fair water quality within Winterpock Creek.

Station ID: 18

Site: Falling Creek at Belmont Road

Latitude: 37.4435

Longitude: 77.5221

Watershed: Falling Creek

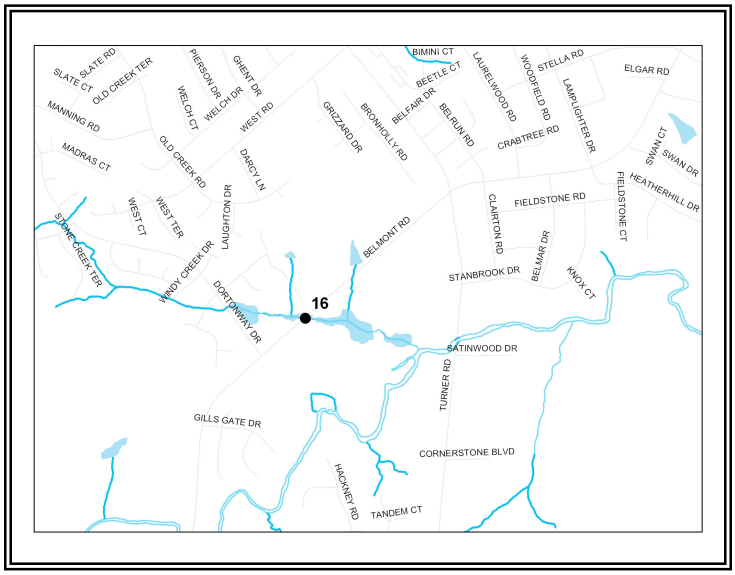
Land use: Residential

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 11.0

Monitoring since: July 2010



This site is located on the mainstem of Falling Creek, one of the major waterways of Chesterfield County. Stream measurements and water samples were obtained on a monthly basis beginning in January at the end of a cul-de-sac on a residential road northwest of Belmont Road. A total of 12 surveys were conducted during 2012.

Table 1-14. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	1	1.20	67.0	6.5	10.5	7.0	16.0	*
February	1	1.25	80.0	6.5	9.9	9.0	19.0	*
March	1	1.30	≥130.0	6.5	7.3	18.0	26.0	*
April	1	1.50	105.0	6.5	7.7	14.0	20.0	*
May	1	1.80	92.0	6.0	6.0	22.0	26.0	*
June	1	1.00	≥130.0	6.5	4.5	25.0	29.0	*
July	1	0.75	66.0	6.5	4.4	26.0	32.0	*
August	1	0.30	≥130.0	6.5	4.9	24.0	26.0	*
September	1	0.70	≥130.0	6.5	6.1	19.0	25.0	*
October	1	1.20	≥130.0	6.0	4.9	16.0	16.0	*
November	1	1.20	95.0	6.5	9.5	7.0	12.0	*
December	1	1.50	≥130.0	6.5	9.0	8.0	10.0	*
2012 Annual Median		1.20	117.5	6.5	6.7	17.0	22.5	*
2011 Annual Median		*1.35*	*≥130.0*	*6.5*	*5.5*	*17.0*	*22.5*	*
2010 Annual Median		*0.50*	*≥130.0*	*6.8*	*7.9*	*18.5*	*21.0*	*

Sampling at this Falling Creek site was conducted from January through December of 2012. Nine survey events occurred during clear/sunny or partly cloudy days and two were conducted on overcast days. The October survey occurred during a period of showers and light rain. Normal baseflow conditions were noted during the January through June surveys and low flows were recorded from July to December. Water coloration was recorded as light brown on all visits. Leaves and debris were present from January through September. As in previous years, no perceptible odors were observed during 2012.

Water depth at this site ranged from a low of 0.30 meters in August to 1.50 meters in December during 2012. The annual median depth for the sampling period was 1.20 meters. Monthly transparency values ranged from a low of 66.0 centimeters in July to over 130.0 centimeters on several occasions. While slightly lower, the annual median transparency value (117.5 centimeters) continued to indicate a high degree of water clarity. All monthly pH values during the year, as well as the annual median (6.5 units), were within the 6.0 - 9.0 unit standard range set by VADEQ. Monthly surface temperatures values ranged from 7.0 to 26.0^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2012. All monthly dissolved oxygen concentrations were above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. The annual median value for dissolved oxygen (6.7 mg/L) remained good. All of the observations to date at this station continue to suggest excellent water quality.

Station ID: 19

Site: Falling Creek at Kay Road

Latitude: 37.4474

Longitude: 77.4468

Watershed: Falling Creek

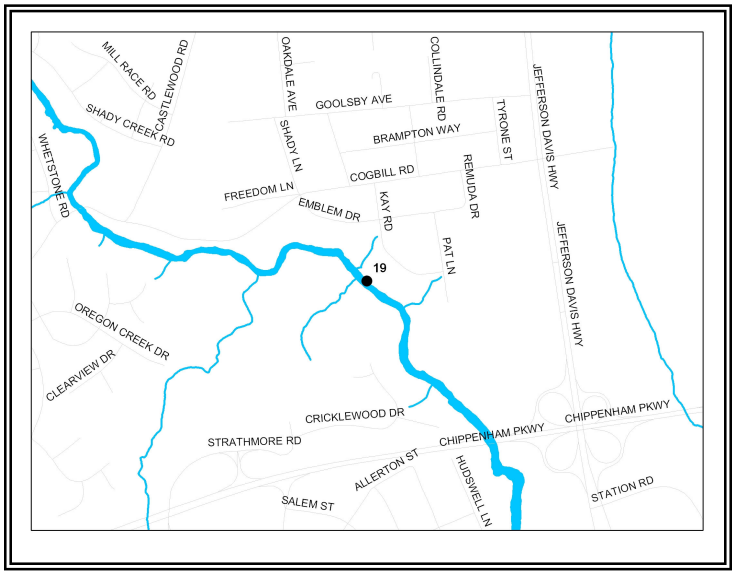
Land use: Residential, County Park

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 9.0

Monitoring since: August 2010



This site is located on the mainstem of Falling Creek, one of the major waterways of Chesterfield County. The site lies adjacent to Falling Creek Park in the northeastern portion of the county. Stream measurements and water samples were obtained once/twice per month during from January through August behind a private residence in the Ranch Acres subdivision. A total of nine surveys were conducted during 2012.

Table 1-15. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	1	0.55	64.2	6.5	11.5	7.0	17.8	*
February	1	0.60	61.2	7.0	12.3	6.0	17.0	*
March	2	0.77	91.1	6.0	11.8	18.0	12.8	*
May	1	0.50	≥130.0	6.5	9.9	21.0	22.0	*
June	2	0.67	76.0	6.8	8.1	25.0	26.2	*
July	1	0.66	54.0	6.5	7.6	26.0	24.0	*
August	1	0.66	51.8	7.0	7.2	28.0	33.8	*
2012 Annual Median		0.63	64.2	6.5	9.9	21.0	22.0	*
2011 Annual Median		*0.53*	*86.0*	*6.5*	*9.9*	*14.0*	*18.3*	*
2010 Annual Median		*0.50*	*≥130.0*	*6.8*	*7.9*	*18.5*	*21.0*	*

Sampling at this Falling Creek site was conducted once or twice a month for seven months during 2012. Three survey events occurred during clear/sunny days and six were conducted on overcast days. Normal baseflow conditions were noted during seven of the surveys and high flows were observed on the March 25 and June 30, 2012 visits. These high flows were the result of antecedent rains. Water coloration was typically varying shades of brown with a green hue recorded in February and July. Leaves and debris were observed on three occasions. As in the previous years, no perceptible odors were observed during 2012.

Water depth at this site ranged from a low of 0.50 meters in May to 0.77 meters in March during 2012. The monitoring period median depth for the sampling area was 0.63 meters. Monthly transparency values and medians ranged from a low of 51.8 centimeters in August to over 130.0 centimeters in May. The monitoring period median value (64.2 centimeters) was less than that observed in the previous two years and represented a continued loss of water clarity at this site. All monthly pH values and medians during the year, as well as the monitoring period median (6.5 units), were within the 6.0 - 9.0 unit standard range set by VADEQ. Monthly median surface temperatures and values ranged from 6.0 to 28.0^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2012. All monthly dissolved oxygen concentrations and medians were well above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. The monitoring period median value for dissolved oxygen (9.9 mg/L) was the same as observed in 2011 and again indicated well-oxygenated waters. All of the observations made during 2012 at this station were suggestive of continued very good water quality.

Station ID: 21

Site: Horner's Run at Fernbrook Park

Latitude: 37.4419

Longitude: 77.5648

Watershed: Falling Creek

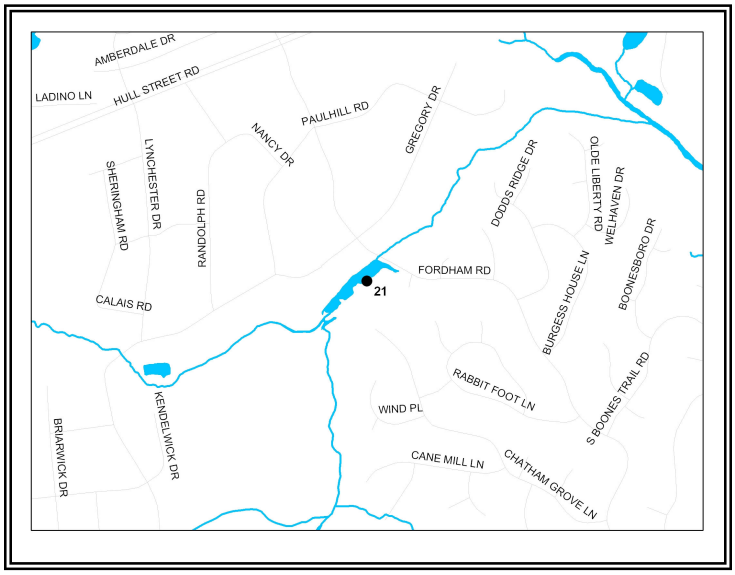
Land use: Residential

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 27.5

Monitoring since: November 2010



This site is located on Horner's Run in the central area of Chesterfield County at Fernbrook Park. Stream measurements and water samples were obtained approximately one to three times per month from January through December just north of the picnic shelter. A total of twenty-two surveys were conducted during 2012.

Table 1-16. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml)
January	1	*	120.0	6.5	11.6	5.0	6.0	*
February	1	*	120.0	6.5	10.0	7.5	7.0	*
March	2	*	94.5	6.5	8.8	14.8	13.8	*
April	1	*	67.0	6.5	6.9	20.5	21.0	*
May	2	*	84.5	6.5	6.0	22.5	24.8	*
June	3	*	76.0	6.5	8.4	25.0	26.0	*
July	3	*	50.0	7.0	7.5	31.0	34.0	*
August	3	*	25.0	6.5	6.5	26.5	27.5	*
September	3	*	75.0	7.0	10.0	23.0	26.5	*
October	1	*	91.0	6.5	9.1	17.0	19.5	*
November	1	*	106.0	6.5	8.2	9.0	11.0	*
December	1	*	55.0	6.0	9.7	5.5	7.5	*
2012 Annual Median		*	75.0	6.5	8.4	22.5	23.8	*
2011 Annual Median		*	*83.5*	*6.5*	*8.7*	*17.8*	*22.3*	*

Sampling of Horner's Run was conducted multiple times over 12 months in 2012. Eighteen survey events occurred on clear/sunny or partly cloudy days and three were conducted on overcast days. Showers and light rain were present during the August 25, 2012 survey. Normal baseflow conditions were noted on four of the surveys (August 11, and October through December 2012) with the remaining observations categorized as high flows. Water coloration was recorded as light brown on most all surveys with one instance of a green hue present in early July. Turbid conditions were noted twice during August. As in past reports, there were no instances of perceptible odors noted in 2012.

The stream was largely devoid of floatable trash, however leaves/debris and pollen were observed on five occasions. Fish and turtles were observed in the stream as well as a variety of waterfowl, songbirds and raptors at this site during the year.

As in previous years, water depth was not measured at this site during 2012. Monthly transparency values and medians ranged from a low of 25.0 centimeters in August to 120.0 centimeters in January and February. The monitoring period median value (75.0 centimeters) was less than that observed in 2011 and represented a slight loss of water clarity at this site. Monthly median pH (6.5 – 7.0 units) and the annual median pH value (6.5 units) were all within the 6.0 - 9.0 unit standard range set by VADEQ and were similar to past observations. Median monthly surface temperatures ranged from a low of 5.0^{o}C in January to a high of 31.0^{o}C in July and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2012. All median dissolved oxygen concentrations and consequently the annual median (8.4 mg/L) were all above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. One dissolved oxygen measurement obtained in early August (3.9 mg/L) was just below the 4.0 mg/L threshold and was attributed to increased water temperatures at the time of sampling. All of the observations made during 2012 at this station were suggestive of continued good water quality.

Station ID: 23

Site: Tributary to Spring Run at Forest Row Trail

Latitude: 37.3837

Longitude: 77.6666

Watershed: Swift Creek

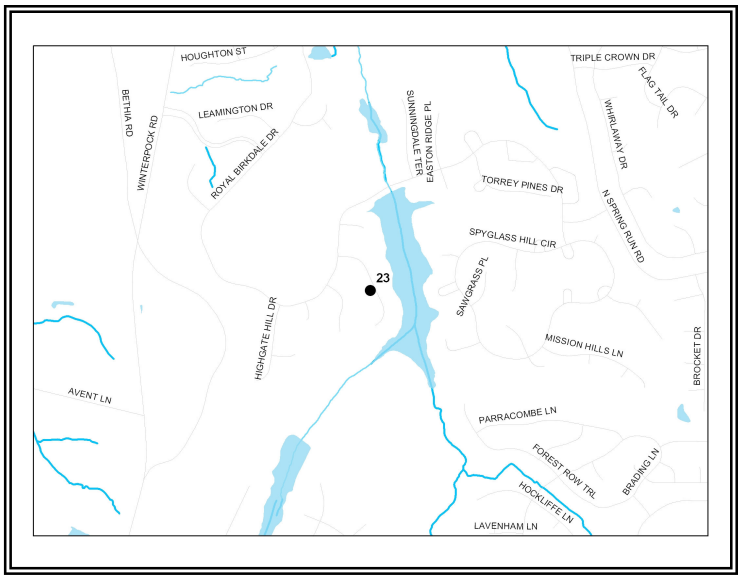
Land use: Residential

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 10.3

Monitoring since: September 2011



This site is located on a tributary to Spring Run in the west central area of Chesterfield County. Stream measurements and water samples were obtained once per month for seven months during the year along the pedestrian footpath located at 14337 Forest Row Trail. A total of seven surveys were conducted during 2012.

Table 1-17. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	1	*	61.8	6.5	8.5	10.0	20.0	*
February	1	*	80.3	6.5	7.4	11.0	18.0	*
March	1	*	65.0	6.0	7.2	18.0	19.0	*
August	1	*	*	6.5	5.5	25.0	29.5	*
September	1	*	95.8	6.5	5.7	23.0	29.0	*
November	1	*	120.0	6.0	3.5	15.0	17.0	*
December	1	*	120.0	6.0	9.0	7.0	11.0	*
2012 Annual Median		*	88.0	6.5	7.2	15.0	19.0	*

Sampling of this reach was conducted during seven months in 2012 with all survey events occurring on clear/sunny or partly cloudy days. Normal baseflow conditions were noted on five of the surveys and low flows were noted during January and March. Clear water was present on all but one survey where a slight milky film was noted (September). Leaves were commonly observed and trash and pollen was recorded during the March survey. There were no perceptible odors present in 2012. Frogs, tadpoles and a variety of insects were observed in and around the stream over the course of the year.

Water depth was not measured at this site during 2012. Transparency values ranged from a low of 61.8 centimeters in January to a high of 120.0 centimeters in November and December during 2012. The annual median transparency value was 88.0 centimeters and was indicative of good water clarity at this site. All measured and median pH values

were similar (6.0 to 6.5 units) and were all within the 6.0 - 9.0 unit standard range set by VADEQ. Surface temperatures varied normally according to season and ranged from 7.0 to 25.0^{o}C. No measurements exceeded the VADEQ standard of 32.0^{o}C. Monthly dissolved oxygen concentrations ranged from a low of 3.5 mg/L in November to 9.0 mg/L in December with a resulting annual median value observed at 7.2 mg/L. The November dissolved oxygen value was the only instance where the level fell below the VADEQ's 4.0 mg/L limit. All of the initial observations made during 2012 at this station were suggestive of very good water quality.

Station ID: 24

Site: Swift Creek at Old Beach Road

Latitude: 37.3682

Longitude: 77.5187

Watershed: Middle Swift Creek

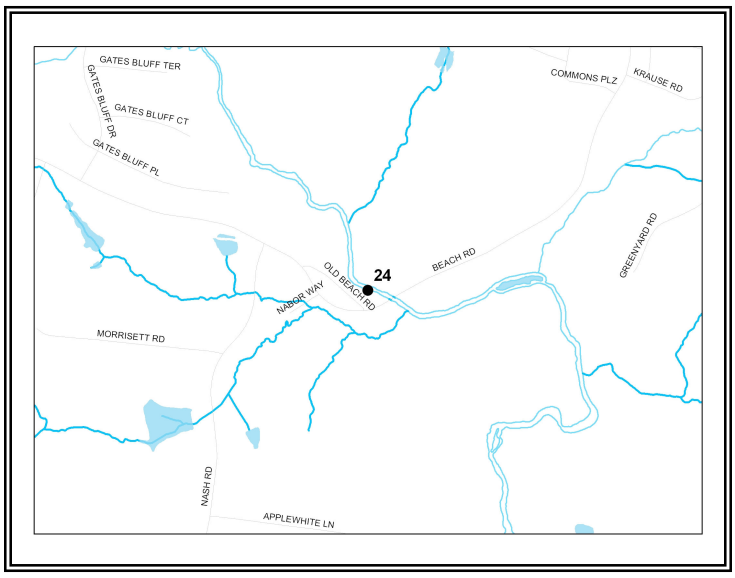
Land use: State Park, Residential

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 3.8

Monitoring since: June 2011



This site is located on the mainstem of Swift Creek, one of the major waterways of Chesterfield County, at its intersection with Old Beach Road. Stream measurements and water samples were obtained once a month during January, February, April and June along the south bank at the base of the historic bridge abutment near 7700 Old Beach Road. A total of four surveys were conducted during 2012.

Table 1-18. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml)
January	1	*	≥130.0	6.5	10.5	10.5	18.5	*
February	1	*	95.0	6.0	11.6	10.5	11.5	*
April	1	*	≥130.0	6.5	7.7	18.0	20.5	*
June	1	*	≥130.0	6.5	5.9	23.5	25.0	*
	2012 Annual Median	*	≥130.0	6.5	9.1	14.3	19.5	*
	2011 Annual Median	*	*119.0*	*6.5*	*5.6*	*26.0*	*27.0*	*

This reach along Swift Creek was sampled four times in 2012. Two survey events occurred on clear/sunny days and two were conducted during overcast days. Normal baseflow conditions were noted on all four of the surveys. Clear water was present on the January visit with a light brown hue observed on the remaining three events. "Earthy" odors were recorded during all four visits in 2012. The presence of numerous aquatic insects on the sites surface was observed during the February survey.

As in the previous year, water depth was not measured at this site during 2012. Transparency values ranged from 95.0 centimeters in February to greater than 130 centimeters for the remainder of the site visits during the monitoring period and were indicative of clear water. The monitoring period median value was greater than 130.0

centimeters. Both individual and the monitoring period median pH values were similar (6.0 or 6.5 units) and were within the 6.0 - 9.0 unit standard range set by VADEQ. Measured surface temperatures were normal for the time of the year measured and did not exceed the VADEQ standard of 32.0^{o}C. The monitoring period dissolved oxygen median concentration was 9.1 mg/L and represented a slight increase from the median observed the previous year. All individual measurements of dissolved oxygen were above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. The limited monitoring at this site continued to suggest excellent water quality.

Station ID: 25

Site: Great Branch at Chalkley Road

Latitude: 37.3620

Longitude: 77.4776

Watershed: Proctors Creek

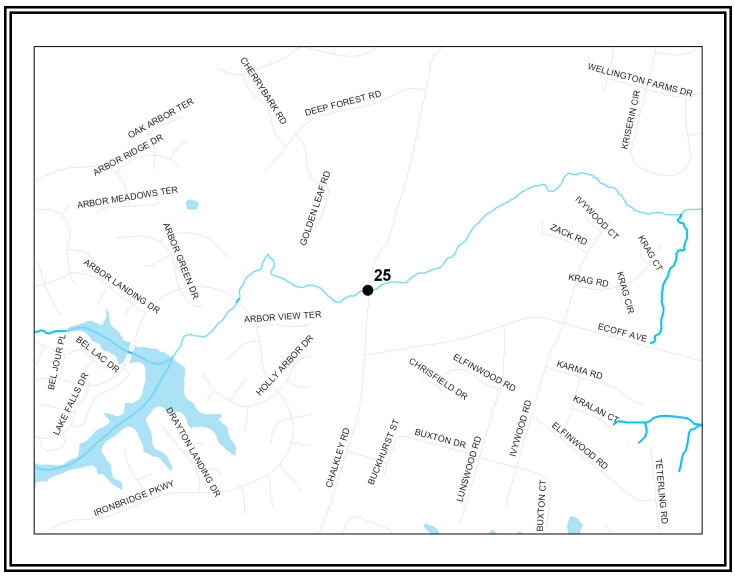
Land use: Residential
Ironbridge Lake

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 7.3

Monitoring since: June 2011



This site is located on the mainstem of Great Branch in the central area of Chesterfield County. Stream measurements and water samples were obtained once per month for seven months at the west side of the Chalkley Road culvert along the south bank of the creek. A total of seven surveys were conducted during 2012.

Table 1-19. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	1	0.50	65.0	6.0	7.6	9.0	12.0	*
February	1	0.75	61.0	6.0	8.8	8.0	11.0	*
March	1	0.50	25.0	6.5	6.2	25.0	22.0	*
April	1	0.50	65.0	5.5	3.7	15.0	19.0	*
August	1	0.50	26.0	6.5	1.7	28.0	31.0	*
September	1	0.40	82.0	6.0	4.1	21.0	25.0	*
November	1	0.60	54.0	6.5	6.1	8.0	10.0	*
2012 Annual Median		0.50	61.0	6.0	6.1	15.0	19.0	
2011 Annual Median		*0.30*	*52.0*	*6.0*	*7.6*	*19.5*	*25.0*	*

Sampling of this reach occurred during seven months in 2012 with all survey events conducted on clear/sunny or partly cloudy days. Normal baseflow conditions were noted on all seven of the surveys. Clear water was present during the January event with the remaining observations of color characterized as varying shades of brown. Turbid conditions were present in April. Leaves and debris were present during November. With the exception of January when there were no perceptible odors, an "earthy" odor was present during the remainder of the surveys.

Water depth at this site ranged from 0.50 to 0.75 meters during 2012 with a monitoring period median depth of 0.50 meters. Transparency values ranged from 25.0 centimeters in March to 75.0 centimeters in February. While slightly improved compared to the

previous year, the monitoring period median transparency value (61.0 centimeters) was still indicative of reduced water clarity. With the exception of the April value (5.5 units); all measured and median pH values were within the 6.0 - 9.0 unit standard range set by VADEQ. Measured surface temperatures ranged from 8.0 to 28.0^{o}C and were normal for the time of the year. No temperature measurement in 2012 exceeded the VADEQ standard of 32.0^{o}C. During 2012, there were two instances where monthly dissolved oxygen concentrations fell below VADEQ's 4.0 mg/L limit. These measurements occurred during April (3.7 mg/L) and August (1.7 mg/L). The remainder of the observations, as well as the monitoring period median for dissolved oxygen (6.1 mg/L), was acceptable. The reduced clarity and low dissolved oxygen observed at this site in 2012 suggest fair water quality.

Station ID: 26

Site: Marine Spring Branch at Kings Farm Drive

Latitude: 37.5518

Longitude: 77.6633

Watershed: James River

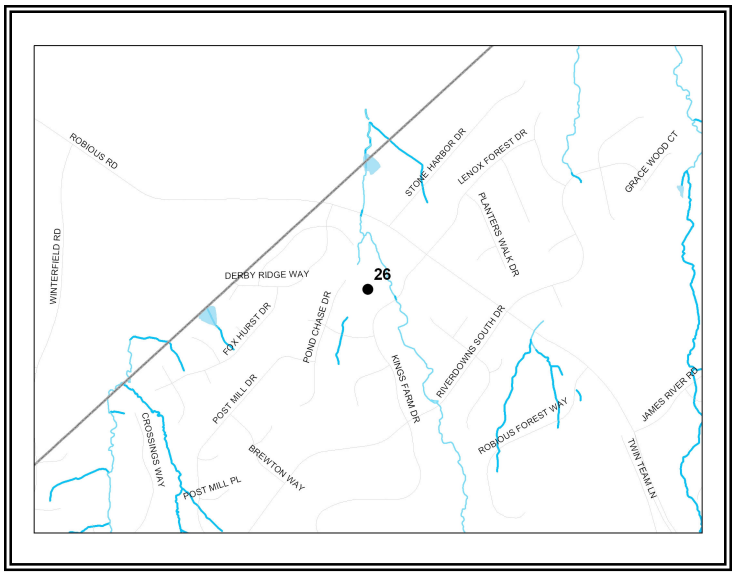
Land use: Residential

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 11.0

Monitoring since: May 2011



This site is located on Marine Spring Branch, a direct drainage to the James River in the northern area of Chesterfield County. Stream measurements and water samples were obtained once or twice per month west of the Kings Farm Drive culvert along the north bank of the creek. A total of 12 surveys were conducted during 2012.

Table 1-20. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	1	0.13	≥130.0	6.5	10.2	8.0	12.5	<100
February	1	0.13	≥130.0	6.5	11.0	9.0	11.0	<100
March	1	0.18	≥130.0	6.0	10.0	12.0	15.0	<100
April	1	0.13	≥130.0	6.0	8.9	14.0	21.0	<100
May	1	0.15	≥130.0	6.0	8.2	19.0	24.0	100
June	2	0.10	≥130.0	7.0	8.8	20.0	24.0	691
July	1	0.01	≥130.0	6.5	4.1	27.0	30.0	540
August	1	0.13	≥130.0	6.5	7.6	25.0	28.0	300
October	1	0.13	≥130.0	7.0	7.8	22.0	27.0	60
November	1	0.13	≥130.0	7.0	9.9	10.0	12.5	20
December	1	0.13	≥130.0	6.0	9.0	11.5	18.0	<20
	2012 Annual Median	0.13	≥130.0	6.5	8.9	14.0	21.0	55.0
	2011 Annual Median	*0.24*	*≥130.0*	*7.0*	*9.8*	*19.5*	*23.5*	*

Surveys were conducted at this Marine Spring Branch reach once per month during January through December of 20121. Water quality and categorical measurements were not made during the June 11, 2012 visit conducted specifically for the collection of an *E. coli* sample. Clear/sunny or partly cloudy conditions were present on seven of the survey events and overcast conditions were recorded for three visits. Normal baseflow conditions were noted on nine of the surveys and low flow was observed during July. Clear water conditions were observed on all occasions with the exception of the March survey when a light brown color was noted. Trash was observed in the stream during October, November and December. There were no perceptible odors present during 2012.

Water depth at this site ranged from 0.01 to 0.18 meters during 2012 with a monitoring period median depth of 0.13 meters. As in the previous year, all individual measurements, and consequently the monitoring period median transparency value, were greater than 130 centimeters and were indicative of a high degree of water clarity. All measured pH values as well as the annual median (6.5 units) were within the 6.0 - 9.0 unit standard range set by VADEQ. Measured surface temperatures ranged from 8.0 to 30.0^{o}C and varied normally with season. No temperature measurement in 2012 exceeded the VADEQ standard of 32.0^{o}C. All monthly dissolved oxygen concentrations and consequently the annual median (8.9 mg/L) were above VADEQ's 4.0 mg/L limit and were indicative of highly oxygenated waters.

Monthly *E. coli* measurements were made at this site during 2012. Samples were incubated for approximately 50 hours at 24^{o}C with resulting densities ranging from <20 to 691 CFU/100ml. There were three instances during the summer of 2012 (June - August) where *E. coli* values exceeded the 235 CFU/100ml VADEQ water quality standard for recreational contact.

All of the observations made during 2012 at this station were suggestive of continued good water quality.

Station ID: 27

Site: Timsbury Creek at Happy Hill Road

Latitude: 37.2995

Longitude: 77.4051

Watershed: Appomattox River

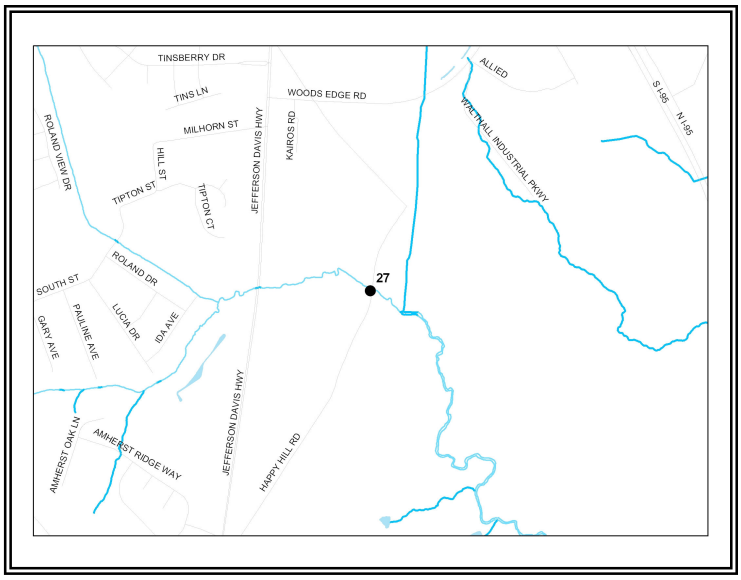
Land use: Residential, Commercial

Number of Stations: 1

Number of Monitors: 3

Volunteer Hours: 12.8

Monitoring since: December 2011



This site is located on Timsbury Creek, a direct drainage to the Appomattox River in the eastern area of Chesterfield County. Stream measurements and water samples were obtained once per month from January through December immediately upstream of the Happy Hill Road crossing. A total of 12 surveys were conducted during 2012.

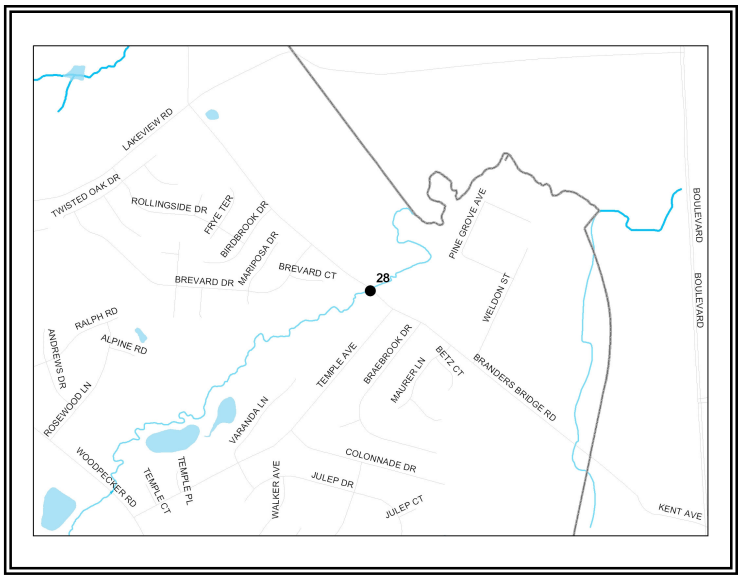
Table 1-21. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml)
January	1	*	40.0	6.5	12.5	13.0	17.0	*
February	1	*	64.0	6.0	12.1	6.0	10.0	*
March	1	*	51.0	6.0	11.1	15.5	20.0	*
April	1	*	51.0	6.0	10.4	15.0	21.0	*
May	1	*	21.0	6.0	10.8	21.0	22.0	*
June	1	*	43.0	6.0	9.0	20.0	27.0	*
July	1	*	43.0	6.0	9.9	26.0	32.0	*
August	1	*	57.2	6.0	9.1	25.0	34.0	*
September	1	*	58.4	6.0	10.6	17.0	17.5	*
November	1	*	77.4	6.0	14.2	6.0	18.0	*
December	1	*	56.4	6.0	14.4	4.0	7.0	*
2012 Annual Median		*	51.0	6.0	10.8	15.5	20.0	*

Surveys were conducted at Timsbury Creek for eleven months from January through December of 2012. Nine survey events occurred on clear/sunny or partly cloudy days, and two visits were made during overcast conditions (February and December). Normal baseflow conditions were noted on six surveys and low flows were present on five. The waters of Timsbury Creek were described as varying shades of light to dark brown and there were no perceptible odors recorded during 2012.

Water depth was not measured at this site during 2012. Transparency values ranged from a low of 21.0 centimeters in May to a high of 77.4 centimeters in November. The annual median transparency value was 51.0 centimeters and was indicative of reduced water clarity. All measured and median pH values were similar (6.0 to 6.5 units) and were all within the 6.0 - 9.0 unit standard range set by VADEQ. Surface temperatures varied normally according to season and ranged from 4.0 to 26.0^{o}C. No measurements exceeded the VADEQ standard of 32.0^{o}C. Monthly dissolved oxygen concentrations ranged from a low of 9.0 mg/L in June to 14.4 mg/L in December with a resulting annual median value observed at 10.8 mg/L. The annual median value was the greatest observed among all sites in 2012 and was indicative of highly oxygenated waters. No observations of dissolved oxygen fell below the VADEQ's 4.0 mg/L limit. The reduced clarity observed combined with the excellent pH, temperature and dissolved oxygen measurements were suggestive of very good water quality at this site.

Station ID: 28



Site: Oldtown Creek at Branders Bridge Road

Latitude: 37.2618

Longitude: 77.4239

Watershed: Appomattox River

Land use: Residential, Forest

Number of Stations: 1

Number of Monitors: 3

Volunteer Hours: 9.0

Monitoring since: December 2011

This site is located on the mainstem of Oldtown Creek, a direct drainage to the Appomattox River in the southeastern area of Chesterfield County. Stream measurements and water samples were obtained once per month from January through December immediately upstream of the Branders Bridge road crossing. A total of 12 surveys were conducted during 2012.

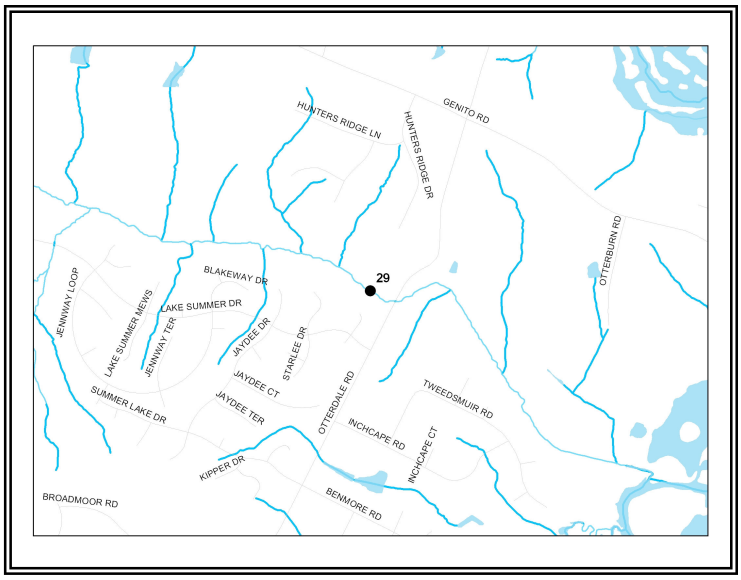
Table 1-22. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	1	*	40.0	6.5	8.9	12.0	18.0	*
February	1	*	52.0	6.5	13.1	8.0	8.0	*
March	1	*	45.0	6.0	9.3	16.5	22.0	*
April	1	*	52.0	6.5	11.0	13.0	19.0	*
May	1	*	22.0	6.0	10.2	24.0	31.0	*
June	1	*	70.0	6.0	7.9	26.0	39.0	*
July	1	*	50.0	6.0	9.4	25.0	27.0	*
August	1	*	46.0	6.0	7.8	26.0	38.0	*
September	1	*	74.6	6.0	9.8	19.0	22.0	*
October	1	*	74.0	6.0	11.0	12.5	20.0	*
November	1	*	68.0	6.0	13.4	5.0	17.0	*
December	1	*	55.2	6.0	10.1	4.0	5.0	*
2012 Annual Median		*	52.0	6.0	10.0	14.8	21.0	*

Sampling at Oldtown Creek occurred from January through December of 2012. Ten survey events were conducted during clear/sunny or partly cloudy days and two were conducted on overcast days. Normal baseflow conditions were noted during the eight of the site visits and low flow was present during June. High flow conditions were observed during April, October and December. Water coloration was recorded as either light or dark brown on all visits. Leaves and debris were present from during April and May and then again in October. Aside from "earthy" odors noted during April and December, there were no other perceptible odors observed during 2012.

Water depth was not measured at this site during 2012. Transparency values ranged from a low of 22.0 centimeters in May to a high of 74.6 centimeters in September. The annual median transparency value was 52.0 centimeters and was indicative of reduced water clarity. All measured and median pH values were similar (6.0 to 6.5 units) and were all within the 6.0 - 9.0 unit standard range set by VADEQ. Surface temperatures varied normally according to season and ranged from 4.0 to 26.0^{o}C. No measurements exceeded the VADEQ standard of 32.0^{o}C. Monthly dissolved oxygen concentrations ranged from a low of 7.8 mg/L in August to 13.4 mg/L in November with a resulting annual median value observed at 10.0 mg/L. The annual median value was one of the greatest observed at all sites in 2012 and indicated highly oxygenated waters. No observations of dissolved oxygen fell below the VADEQ's 4.0 mg/L limit. The reduced clarity observed combined with the excellent pH, temperature and dissolved oxygen measurements were suggestive of very good water quality at this site.

Station ID: 29



Site: Otterdale Branch at Lake Summer Place

Latitude: 37.4416

Longitude: 77.7119

Watershed: Swift Creek Reservoir

Land use: Residential, Forest

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 9.1

Monitoring since: November 2011

This site is located on Otterdale Branch, a major drainage to the Swift Creek Reservoir located in the northwestern portion of Chesterfield County. Stream measurements and water samples were obtained once/twice per month from January through December just off the pedestrian trail located behind 4400 Lake Summer Place. A total of 12 surveys were conducted during 2012.

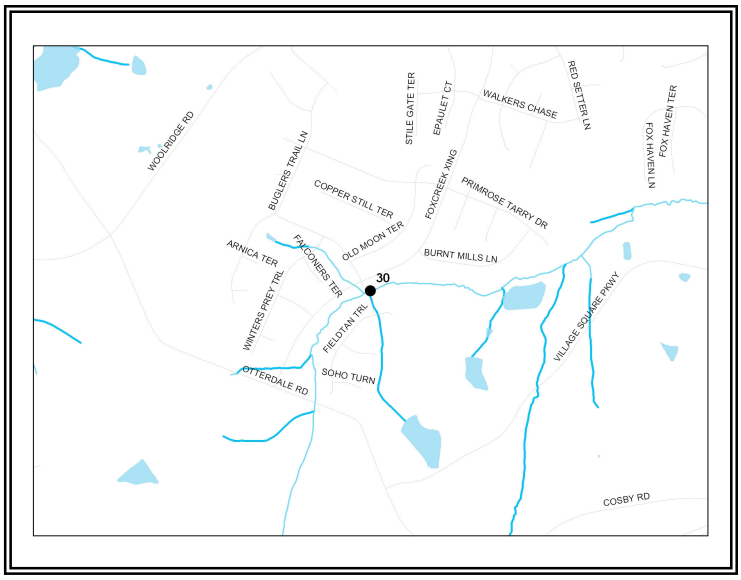
Table 1-23. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	1	*	105.0	6.5	11.0	7.2	13.5	*
February	1	*	≥130.0	6.5	9.5	11.0	15.5	*
March	1	*	≥130.0	6.5	8.9	15.5	21.0	*
April	1	*	≥130.0	6.5	9.3	13.5	16.0	*
June	2	*	111.0	6.3	4.6	25.5	30.3	*
August	2	*	108.0	7.0	4.4	25.0	34.0	*
September	1	*	91.0	6.5	5.8	15.5	19.0	*
October	1	*	39.3	6.5	3.2	14.5	15.5	*
November	1	*	77.5	6.5	5.7	8.0	18.0	*
December	1	*	46.0	*	10.7	3.5	5.5	*
2012 Annual Median		*	105.0	6.5	5.8	14.5	18.5	*

Surveys were conducted at Otterdale Branch for ten months from January through December of 2012. Eleven survey events occurred on clear/sunny or partly cloudy days with one site visit held during overcast conditions (March). Normal baseflow conditions were present from January to April and again in December. Low flow was present from June through November. The stream was observed to be dry during the August 4, 2012 survey. Clear water was noted on five occasions with the remaining majority of the color observations characterized as varying shades of brown and/or green. Algae, leaves, debris and pollen were frequently observed from January through March and again from October through December. No perceptible odors were recorded during 2012.

Water depth was not measured at this site during 2012. Water clarity as measured by transparency ranged from a low of 39.3 centimeters in October to greater than 130.0 centimeters from February through March. The annual median value was calculated at 105.0 centimeters and was indicative of very clear water. All measured and median pH values were within the 6.0 - 9.0 unit standard range set by VADEQ. Measured surface temperatures ranged from 3.5 to 25.5^{o}C and varied normally with season. No temperature measurement in 2012 exceeded the VADEQ standard of 32.0^{o}C. With the exception of an individual measurement in June (3.3 mg/L) and one in October (3.2 mg/l), all other monthly dissolved oxygen concentrations and consequently the annual median (5.8 mg/L) were above VADEQ's 4.0 mg/L limit and were indicative of adequately oxygenated waters. Overall measurements at this site were characteristic of very good water quality.

Station ID: 30



Site: Westbranch at Prescotts Level

Latitude: 37.4086

Longitude: 77.7132

Watershed: Swift Creek Reservoir

Land use: Residential, Forest

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 9.6

Monitoring since: January 2012

This site is located on Westbranch, a major drainage to the Swift Creek Reservoir located in the northwestern portion of Chesterfield County. Stream measurements and water samples were obtained once/twice per month from January through December along the south bank of the stream immediately west of the Prescotts Level culvert. A total of 12 surveys were conducted during 2012.

Table 1-24. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
January	1	*	≥130.0	6.5	5.9	25.5	30.5	*
February	1	*	≥130.0	6.5	9.7	9.0	16.0	*
March	1	*	≥130.0	6.5	8.7	16.8	23.2	*
April	1	*	≥130.0	6.5	9.0	14.0	14.5	*
June	2	*	≥130.0	6.5	5.8	26.3	31.8	*
August	2	*	114.3	6.5	4.7	26.3	28.0	*
September	1	*	112.5	6.5	7.3	19.0	28.0	*
October	1	*	87.8	6.5	4.8	15.5	13.5	*
November	1	*	86.4	6.5	7.5	9.5	15.5	*
December	1	*	≥130.0	*	9.9	5.0	6.5	*
2012 Annual Median		*	≥130.0	6.5	6.6	17.9	25.1	*

Surveys were conducted at Westbranch for ten months from January through December of 2012. Eleven survey events occurred on clear/sunny or partly cloudy days with one site visit held during overcast conditions (March). Normal baseflow conditions were present from February to April and again in November and December. Low flow was observed from June through October as well as in January. Clear water was noted on all 12 site visits with an additional notation of a green hue present during March. No perceptible odors were recorded during 2012.

Water depth was not measured at this site during 2012. Water clarity as measured by transparency ranged from a low of 86.4 centimeters in November to greater than 130.0

centimeters on multiple occasions during the year. The annual median transparency value was calculated at ≥130.0 centimeters and indicated a high degree of water clarity. All measured and median pH values were within the 6.0 - 9.0 unit standard range set by VADEQ and varied little if any throughout the year. Measured surface temperatures ranged from 5.0 to 26.3^{o}C and varied normally with season. No temperature measurement in 2012 exceeded the VADEQ standard of 32.0^{o}C. With the exception of an individual measurement in late August (3.7 mg/L), all monthly dissolved oxygen concentrations and consequently the annual median (6.6 mg/L) were above VADEQ's 4.0 mg/L limit and were indicative of adequately oxygenated waters. Overall measurements at this site were characteristic of very good water quality.

Station ID: 32

Site: Tributary to Powhite Creek at Bloomfield Road

Latitude: 37.5227

Longitude: 77.5410

Watershed: James River

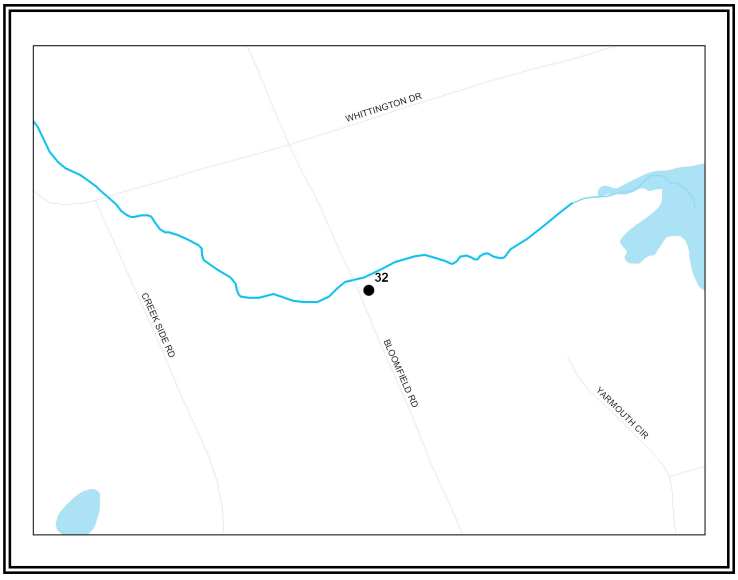
Land use: Residential, Forest

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 22.0

Monitoring since: June 2012



This site is located on a Tributary to Powhite Creek, a direct drainage to the James River located in the northeastern portion of Chesterfield County. Stream measurements and water samples were obtained once/twice per month from June through December on the east side of Bloomfield Road at the downstream end of the culvert. A total of 11 surveys were conducted during 2012.

Table 1-25. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
June	2	*	49.6	6.5	4.0	19.3	25.5	*
July	1	*	56.3	7.0	3.1	26.0	25.0	*
August	1	*	115.0	7.0	4.0	25.0	30.0	*
September	2	*	66.5	7.0	5.1	18.5	20.0	*
October	2	*	54.5	7.0	5.2	15.0	15.5	*
November	2	*	53.5	7.0	4.5	16.0	16.0	*
December	1	*	56.0	7.0	4.9	18.0	17.0	*
2012 Annual Median		*	56.0	7.0	4.4	18.0	20.0	*

Surveys were conducted at this Tributary to Powhite Creek for six months from June through December of 2012. Eight survey events occurred on clear/sunny or partly cloudy days with two site visits held during overcast conditions (June 18 and September 29, 2012). Rain was present during the October 29, 2012 survey. Normal baseflow conditions were present during all but one survey (June 27) when low flow was noted. With the exception of the August 30, 2012, survey where clear water was recorded, all observations of color were described as light brown. No perceptible odors were recorded during 2012.

Water depth was not measured at this site during 2012. Water clarity as measured by transparency ranged from a low of 49.6 centimeters in June to 115.0 centimeters in August. The annual median transparency value was calculated at 56.0 centimeters and

was indicative of reduced water clarity. All measured and median pH values were within the 6.0 - 9.0 unit standard range set by VADEQ. Measured surface temperatures ranged from 15.0 to 26.0^{o}C and varied normally with season. No temperature measurement in 2012 exceeded the VADEQ standard of 32.0^{o}C. With the exception of individual measurements in early June (3.9 mg/L) and July (3.1 mg/L), all monthly dissolved oxygen concentrations were just above VADEQ's 4.0 mg/L limit. While above the threshold, the annual median value for dissolved oxygen (4.4 mg/L) was among the lowest recorded and indicated minimally acceptable oxygenated waters. Overall measurements at this site were characteristic of fair water quality.

Station ID: 33

Site: Little Tomahawk Creek at Midlothian High School

Latitude: 37.4943

Longitude: 77.6605

Watershed: Swift Creek Reservoir

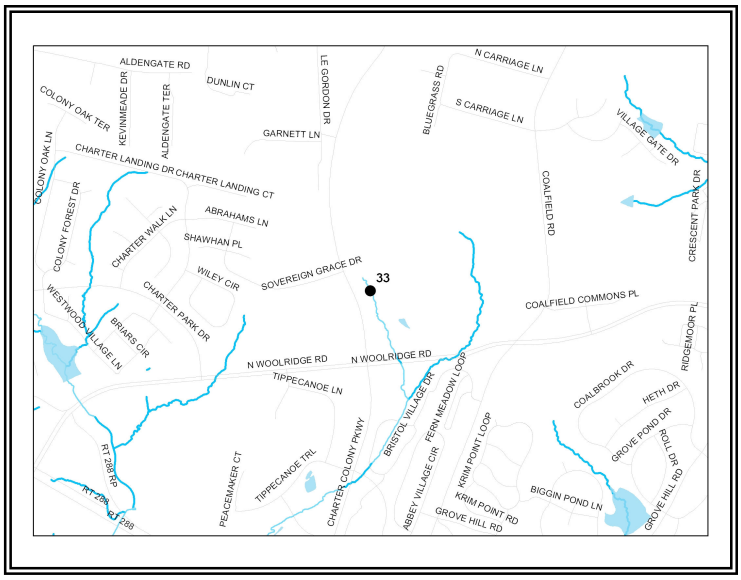
Land use: Residential, Commercial, School

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 7.0

Monitoring since: March 2012



This site is located at the headwaters of Little Tomahawk Creek, a major drainage to the Swift Creek Reservoir located in the northwestern portion of Chesterfield County. Stream measurements and water samples were obtained once per month from March through October downhill from the Midlothian High School parking lot along the east site of the creek. A total of seven surveys were conducted during 2012.

Table 1-26. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
March	1	*	115.0	6.5	6.2	17.0	25.5	*
May	1	*	100.0	6.0	6.3	17.0	27.0	40
June	1	*	119.0	6.0	6.5	18.0	26.0	20
July	1	*	101.0	6.5	5.7	22.0	26.5	67
August	1	*	116.0	6.0	5.3	22.0	27.0	20
September	1	*	90.0	6.0	6.3	19.0	25.0	60
October	1	*	105.0	7.0	6.5	22.0	23.0	100
2012 Annual Median		*	105.0	6.0	6.3	19.0	26.0	50

Surveys were conducted at Little Tomahawk Creek for seven months from March through October of 2012. Except for the October survey where overcast conditions were present, all other survey events (six) occurred on clear/sunny or partly cloudy days. Low flows were present during all survey events in 2012. Clear water was observed on all but one survey event in 2012. A light brown color was recorded during the September survey and an additional notation of light brown was made during June. "Earthy" odors were frequently present during the year. No perceptible odors were recorded during the May and September surveys.

Water depth was not measured at this site during 2012. Water clarity as measured by transparency ranged from a low of 90.0 centimeters in September to 115.0 centimeters in March. The annual median transparency value was calculated at 105.0 centimeters and was indicative of clear water. All measured and median pH values were at or within the 6.0 - 9.0 unit standard range set by VADEQ. Measured surface temperatures ranged from 17.0 to 22.0^{o}C and varied normally with season. No temperature measurement in 2012 exceeded the VADEQ standard of 32.0^{o}C. Monthly dissolved oxygen concentrations ranged from 5.3 mg/L to 6.5 mg/L with a resulting annual median value observed at 6.3 mg/L. No observations of dissolved oxygen fell below the VADEQ's 4.0 mg/L limit.

Six *E. coli* measurements were made at this site from March through October. Densities observed in 2012 ranged from less than 20 to 100 CFU/100ml. None of the samples exceeded the 235 CFU/100ml VADEQ *E. coli* water quality standard for recreational contact.

All of the observations made during 2012 at this station were suggestive of excellent water quality.

Station ID: 34

Site: Second Branch at Nash Road

Latitude: 37.3221

Longitude: 77.5573

Watershed: Swift Creek

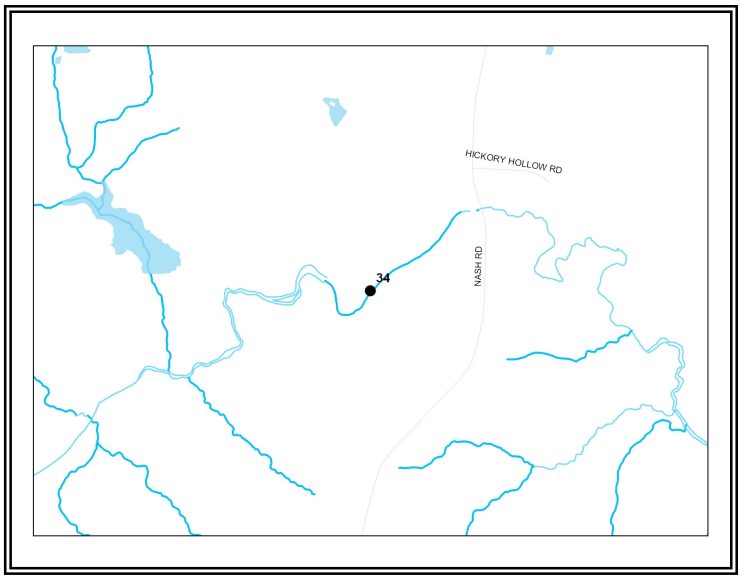
Land use: Residential, Forest

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 9.0

Monitoring since: March 2012



This site is located on Second Branch in the south central area of Chesterfield County at its crossing with Nash Road. Stream measurements and water samples were obtained once per month from March through December at the end of the path immediately behind 12900 Nash Road along the south bank of the stream. A total of nine surveys were conducted during 2012.

Table 1-27. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
March	1	1.22	52.0	6.5	12.0	17.0	24.0	*
April	1	1.16	75.6	5.5	10.0	17.0	23.0	*
May	1	1.30	58.4	6.0	10.7	6.0	28.0	*
July	1	0.76	37.0	6.0	5.3	27.0	29.0	*
August	1	0.84	38.2	5.0	6.6	25.5	27.0	*
September	1	0.61	74.0	5.0	9.7	20.0	21.5	*
October	1	1.07	42.0	5.0	8.7	10.0	15.0	*
November	1	1.22	93.0	4.5	10.0	5.0	6.0	*
December	1	1.22	55.0	5.0	9.0	7.0	6.0	*
2012 Annual Median		1.16	55.0	5.0	9.7	17.0	23.0	*

Surveys were conducted at this Second Branch reach once per month from March through December of 2012. All nine survey events occurred on clear/sunny or partly cloudy days. Normal baseflow conditions were noted during May, July and August and again in November. Low flow was present during the spring and fall months. A single notation of a slightly high flow was made during the December survey following a period of antecedent rain. Water coloration was recorded as either light or dark brown on all visits. Algae, leaves and debris were present from during March, April and May. "Earthy" odors were frequently present during the year. No perceptible odors were recorded during the September, October and December surveys.

Water depth at this site ranged from 0.61 to 1.30 meters during 2012 with a monitoring period median depth of 1.16 meters. Water clarity as measured by transparency ranged from a low of 37.0 centimeters in July to 93.0 centimeters in November. The annual median transparency value was calculated at 55.0 centimeters and was indicative of reduced water clarity. Measurements of pH ranged from 4.5 to 6.0 units with an annual median value reported as 5.0 units. Six monthly pH values as well as the annual median were below the 6.0 unit standard set by VADEQ. The annual median pH value was additionally the lowest recorded among all sites in 2012. This is not surprising as Second Branch has been listed on the VADEQ impaired waters list since 2010 for "naturally occurring" low pH. Measured surface temperatures ranged from 5.0 to 27.0^{o}C and were normal for the time of the year. No temperature measurement in 2012 exceeded the VADEQ standard of 32.0^{o}C. All monthly dissolved oxygen concentrations and consequently the annual median (9.7 mg/L) were well above VADEQ's 4.0 mg/L limit and were indicative of highly oxygenated waters. Despite the observed reduced transparency, the excellent oxygen levels and naturally low pH at this site suggest good water quality

Station ID: 35

Site: Swift Creek at Pocohontas State Park

Latitude: 37.3898

Longitude: 77.5759

Watershed: Swift Creek

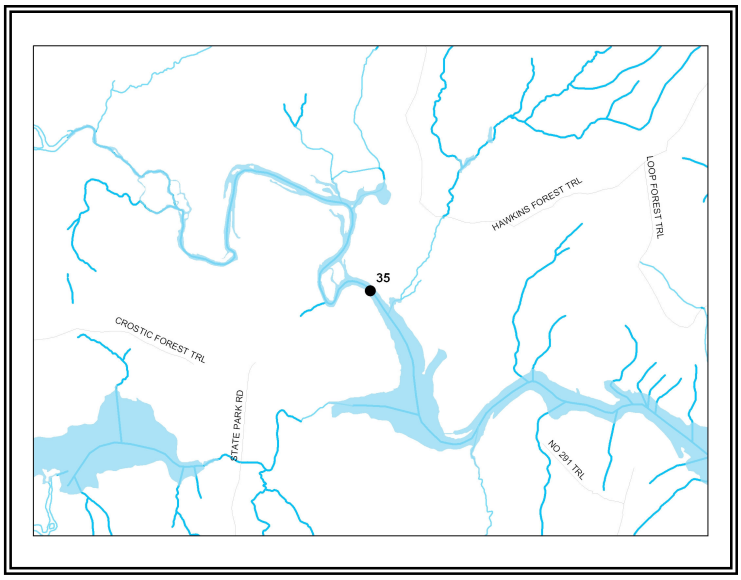
Land use: Residential, Commercial, Forest, Park

Number of Stations: 1

Number of Monitors: 2

Volunteer Hours: 14.5

Monitoring since: March 2012



This site is located on the mainstem of Swift Creek, one of the major waterways of Chesterfield County. The site lies within the confines of Pocohontas State Park in the central portion of Chesterfield County. Stream measurements and water samples were obtained from Swift Creek once/twice a month from March through December at the pedestrian bridge where the creek joins with Swift Creek Lake. A total of 10 surveys were conducted during 2012.

Table 1-28. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
March	1	2.90	120.0	6.5	7.1	17.8	19.0	*
April	1	3.00	95.0	6.5	7.8	20.0	26.0	*
May	1	*	87.0	6.5	7.2	22.0	25.0	*
June	1	2.60	75.0	6.5	7.5	33.0	40.0	*
July	1	2.40	59.0	7.0	7.8	32.0	42.0	*
August	1	2.70	69.0	6.5	7.1	25.0	27.0	*
September	1	2.80	94.0	6.5	7.4	23.0	25.0	*
October	1	2.30	94.0	6.5	7.3	16.0	15.0	*
December	2	2.70	76.5	6.5	8.6	7.5	16.0	*
2012 Annual Median		2.70	90.5	6.5	7.5	21.0	25.0	*

Surveys were conducted at this Swift Creek reach over a nine month period during 2012. Seven survey events occurred on clear/sunny or partly cloudy days and three visits were conducted during periods of overcast weather (August, October and December). Normal baseflow conditions were noted on all occasions. The waters of this Swift Creek reach were most often described as being clear accompanied with varying green or brown hues. The presence of algae, leaves, debris and pollen were frequently recorded throughout the year. There were no perceptible odors recorded during 2012.

Water depth at this site ranged from 2.30 to 3.00 meters during 2012 with a monitoring period median depth of 2.70 meters. Water clarity as measured by transparency ranged from a low of 59.0 centimeters in July to a high of 120.0 centimeters in March. The annual median transparency value was calculated at 90.5 centimeters and was indicative of good water clarity. All measured and median pH values were similar (6.5 or 7.0 units) and were within the 6.0 - 9.0 unit standard range set by VADEQ. Measured surface temperatures ranged from 7.5 to 33.0^{o}C and were normal for the time of the year. Two temperature measurements in 2012 either were at or exceeded the VADEQ standard of 32.0^{o}C. These observations occurred in June (33.0^{o}C) and July (32.0^{o}C) during a period of hot ambient air temperatures (40-42^{o}C) and were not attributed to any water quality concern. All monthly dissolved oxygen concentrations and consequently the annual median (7.5 mg/L) were well above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. All of the observations made during 2012 at this station were suggestive of very good water quality.

Station ID: 36

Site: Marine Spring Branch at Knights Run Drive

Latitude: 37.5465

Longitude: 77.6597

Watershed: James River

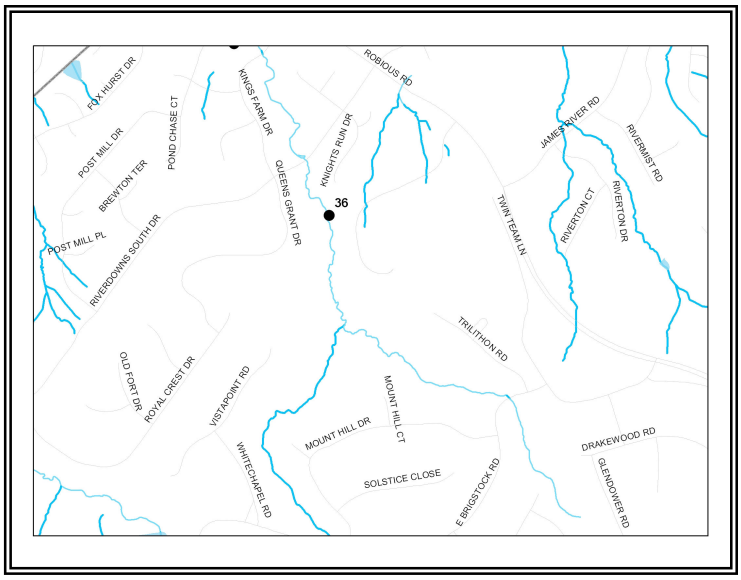
Land use: Residential

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 20.0

Monitoring since: August 2012



This site is located on Marine Spring Branch, a direct drainage to the James River in the northern area of Chesterfield County. Stream measurements and water samples were obtained twice per month approximately 75 meters southwest of 13800 Knights Run Drive. A total of ten surveys were conducted during 2012.

Table 1-29. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
August	2	*	≥130.0	6.8	7.0	23.0	26.0	*
September	2	*	≥130.0	7.0	7.4	20.5	21.8	*
October	2	0.15	≥130.0	6.3	7.4	13.5	16.0	*
November	2	0.14	≥130.0	6.8	9.0	6.5	11.5	*
December	2	0.16	≥130.0	7.0	10.7	5.8	9.8	*
2012 Annual Median		0.15	≥130.0	7.0	7.8	13.5	16.0	*

Surveys were conducted at this Marine Spring Branch reach for five months beginning in August 2012. Eight survey events occurred on clear/sunny or partly cloudy days. Overcast conditions were present during the October 29 and December 31, 2012 visits. Normal baseflow conditions were noted on all half of the bimonthly surveys with the remaining half characterized as low flow. The majority of the low flow observations were recorded during the October and November surveys. The waters of Marine Spring Branch were clear on all monitoring visits. Leaves were the most often described floatable with trash and debris mentioned during the August 26 and September 29, 2012 surveys. Aside from one "earthy" odor described in early October, there were not any perceptible odors recorded during 2012. Minnows, newts and tadpoles were observed during several monitoring events.

Water depth at this site was measured from October through December 2012 and ranged from 0.14 to 0.16 meters. The monitoring period median depth was measured at 0.15 meters. All individual measurements, and consequently the monitoring period median transparency value, were greater than 130 centimeters and were indicative of a high degree of water clarity. All measured and median pH values were within the 6.0 - 9.0 unit standard range set by VADEQ. Measured surface temperatures ranged from 5.8 to 23.0^{o}C and were normal for the time of the year. No temperature measurement in 2012 exceeded the VADEQ standard of 32.0^{o}C. All monthly dissolved oxygen concentrations and consequently the annual median (7.8 mg/L) were well above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. All of the observations made during 2012 at this station were suggestive of excellent water quality.

Station ID: 37

Site: Tributary to Michaux Creek at Lastingham Drive

Latitude: 37.5223

Longitude: 77.6843

Watershed: James River

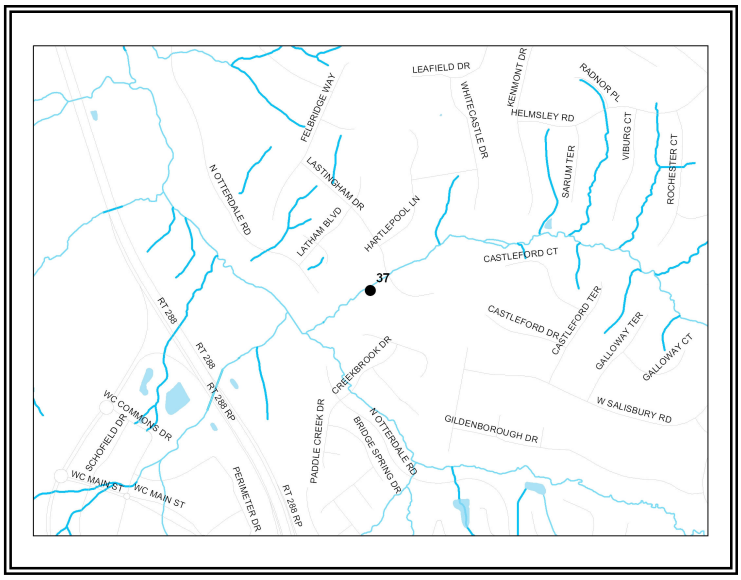
Land use: Residential, Forest

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 17.0

Monitoring since: August 2012



This site is located on a tributary to Michaux Creek, a direct drainage to the James River in the northern area of Chesterfield County. Stream measurements and water samples were obtained one to four times per month from August to December at Lastingham Drive. A total of 13 surveys were conducted during 2012.

Table 1-30. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
August	1	1.00	≥130.0	6.5	5.8	22.5	27.5	*
September	4	1.00	≥130.0	6.5	7.9	17.8	23.8	*
October	2	1.00	≥130.0	6.5	8.0	17.5	22.5	*
November	3	1.00	≥130.0	6.5	10.1	8.5	14.0	*
December	3	1.00	≥130.0	6.5	10.3	13.5	13.5	*
2012 Annual Median		1.00	≥130.0	6.5	8.6	15.5	19.0	*

Surveys were conducted at the Tributary to Michaux Creek reach for five months beginning in August 2012. Nine survey events occurred on clear/sunny or partly cloudy days. Overcast conditions were noted during three visits and showers were present on the December 5, 2012 survey. Normal baseflow conditions were noted on all ten of the site visits. The stream's water was clear on most all monitoring visits with slightly murky or milky conditions recorded twice during September, attributable to antecedent rains. Leaves and debris were observed during November and December. There were no perceptible odors recorded during 2012. Minnows, water striders and frogs were observed throughout the monitoring period.

Water depth at this site was measured from August through December 2012 with all monthly medians reported as 1.00 meters. With the exception of one measurement in early September (35.0 cm) all individual measurements, and consequently the monitoring

period median transparency value, were greater than 130 centimeters and were indicative of a high degree of water clarity. All measured and median pH values were recorded as 6.5 units indicating a stable system and were within the 6.0 - 9.0 unit standard range set by VADEQ. Measured surface temperatures ranged from 8.5 to 22.5^{o}C and were normal for the time of the year. No temperature measurement in 2012 exceeded the VADEQ standard of 32.0^{o}C. All monthly median dissolved oxygen concentrations and consequently the annual median (8.6 mg/L) were well above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. All of the observations made during 2012 at this station were suggestive of excellent water quality.

Station ID: 38

Site: Lake Salisbury at the Community Dock

Latitude: 37.5190

Longitude: 77.6431

Watershed: Falling Creek

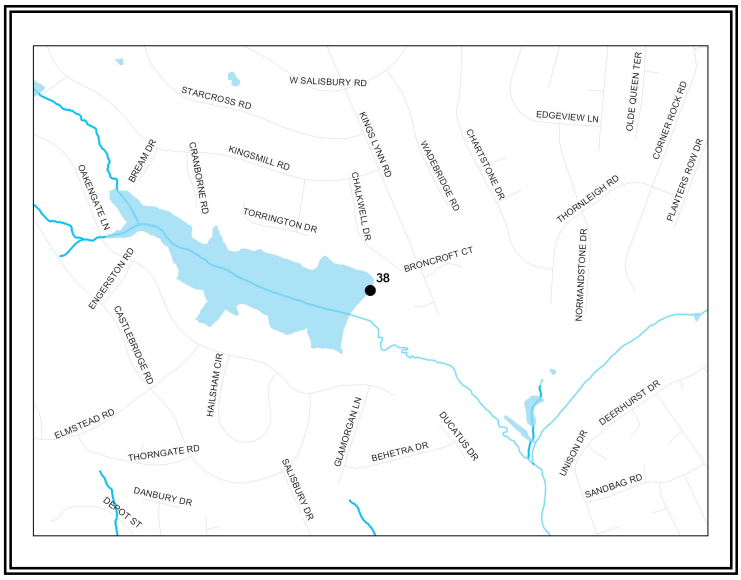
Land use: Residential, Forest

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 20.0

Monitoring since: August 2012



This site is located on Lake Salisbury, an amenity impoundment located at the headwaters of Falling Creek in the northern area of Chesterfield County. Water Quality measurements and samples were obtained twice per month from August through December from the community dock at the swimming beach. A total of ten surveys were conducted during 2012.

Table 1-31. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
August	2	*	53.5	7.8	7.1	27.0	28.5	*
September	2	*	56.0	7.5	7.3	18.5	23.0	*
October	2	*	54.0	7.5	7.3	10.8	11.0	*
November	2	*	52.5	7.5	7.4	11.5	12.8	*
December	2	*	53.0	6.0	7.6	7.5	8.0	*
Median	2012 Annual Median	*	54.0	7.5	7.4	11.8	12.8	*

Surveys were conducted at Lake Salisbury for five months beginning in August 2012. Six survey events occurred on clear/sunny or partly cloudy days and overcast conditions were noted during four visits. The lake's surface water conditions were described as being calm or having ripples present on all occasions. The lake's water was clear on all but one monitoring event where a green hue was noted (October 10, 2012). Algae and leaves were common and observed during all visits in 2012. "Earthy" odors were frequently present during the year. No perceptible odors were recorded during the September 5 and December 4, 2012 surveys.

Water depth was not measured at this site during 2012. Water clarity as measured by transparency ranged from a median low of 52.5 centimeters in November to a high of 56.0 centimeters in September. The annual median transparency value was calculated at

54.0 centimeters and was indicative of reduced water clarity. All monthly median pH values as well as the monitoring period median were within the 6.0 - 9.0 unit standard range set by VADEQ. Monthly median surface temperatures ranged from 7.5 to 27.0^{o}C and were normal for the time of the year. No individual or median values exceeded the VADEQ standard of 32.0^{o}C. All monthly median dissolved oxygen concentrations and consequently the annual median (7.4 mg/L) were well above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. All of the observations made during 2012 at this station were suggestive of very good water quality.

Station ID: 39

Site: Spring Run at Mockingbird Lane

Latitude: 37.4081

Longitude: 77.6419

Watershed: Swift Creek

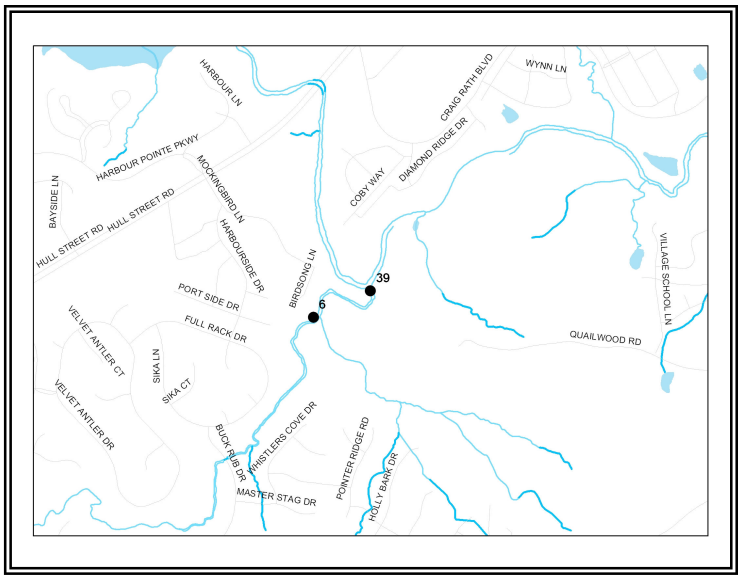
Land use: Residential

Number of Stations: 1

Number of Monitors: 1

Volunteer Hours: 12.9

Monitoring since: September 2012



This site is located on Spring Run in the west central area of Chesterfield County near its confluence with Swift Creek. Stream measurements and water samples were obtained two to four times per month from September through December. A total of 12 surveys were conducted during 2012.

Table 1-32. Monthly values and annual medians for each water quality parameter measured during 2012. Monthly values where n≥2 are expressed as the median.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
September	4	*	111.3	6.8	4.2	19.0	20.0	*
October	3	*	≥130.0	7.0	5.2	15.5	15.0	*
November	3	*	≥130.0	7.0	9.2	8.5	13.5	*
December	2	*	≥130.0	7.0	9.4	9.3	11.5	*
2012 Annual Median		*	≥130.0	7.0	6.4	14.3	15.8	*

Surveys were conducted at this Spring Run reach for four months beginning in September 2012. Six survey events occurred on clear/sunny or partly cloudy days with overcast conditions noted during two visits. Overcast with showers were present during late September and early October as well as during both December surveys. Normal baseflow conditions were noted on seven of the site visits and high flows were present on five. The stream's water was described as clear with varying shades of brown. A foamy/oily sheen was observed during the November 11, 2012 survey. Trash and leaves/debris were observed during all visits. "Earthy" and "Rotten Egg" odors were present during September and again in late November and December 2012. Streambank erosion and scour was mentioned in the notes for this reach during 2012.

Water depth was not measured at this site during 2012. With the exception of the September median (111.3 cm) all monthly medians as well as the monitoring period median transparency value were greater than 130 centimeters and were indicative of a high degree of water clarity. All monthly medians, the monitoring period median and

individual values of pH were within the 6.0 - 9.0 unit standard range set by VADEQ. Measured surface temperatures ranged from a median of 8.5 to 19.0^{o}C and were normal for the time of the year. No temperature measurement in 2012 exceeded the VADEQ standard of 32.0^{o}C. All monthly median dissolved oxygen concentrations and consequently the annual median (6.4 mg/L) were above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. All of the observations made during 2012 at this station were suggestive of excellent water quality.

Station ID: 200

Lake: Walton Lake

Surface Acreage: 26

Latitude: 37.4772

Longitude: 77.6325

Watershed: Falling Creek

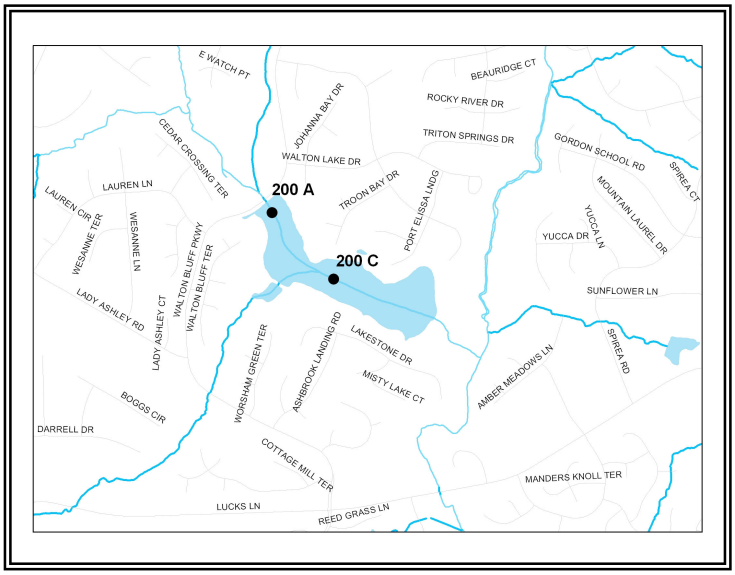
Land use: Residential

Number of Stations: 2

Number of Monitors: 1

Volunteer Hours: 15.3

Monitoring since: Spring 2004



Walton Lake is a manmade waterbody that was constructed and used as an amenity for the Isaac Walton League Hunt Club until the mid 1980s. The current dam was built in 1988 with the establishment of the Walton Lake subdivision. Homes surround the entire lake with the majority of the lakeside buffer as residential lawn. Residents utilize the lake for recreation such as boating and fishing. The entire watershed was built out with both residential and commercial development. This year marked the seventh consecutive season of sampling since monitoring was temporarily suspended in 2005.

Table 1-33. Monthly and annual median values for each water quality parameter measured, 2012.

Date	n	Water Depth (m)	Secchi Depth (m)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml
April	2	1.9	0.94	7.0	9.3	20.8	24.0	<20
May	4	1.8	0.80	7.0	8.3	21.5	27.0	*
June	4	1.9	0.59	7.0	9.3	28.0	30.5	25
July	2	1.9	0.44	7.0	9.5	29.0	33.5	<20
August	2	1.9	0.45	7.0	9.5	29.0	31.0	25
September	2	2.3	0.64	7.0	9.4	25.0	27.0	<20
October	2	2.0	0.94	7.0	9.7	20.0	25.0	<20
2012 Annual Median		1.90	0.64	7.0	9.3	25.0	27.5	<20
2011 Annual Median		*1.87*	*0.73*	*7.0*	*8.1*	*23.8*	*25.0*	*
2010 Annual Median		*1.24*	*0.67*	*7.5*	*5.1*	*26.0*	*30.0*	*
2009 Annual Median		*1.40*	*0.80*	*7.0*	*3.5*	*25.0*	*25.0*	*
2008 Annual Median		*1.31*	*0.84*	*7.0*	*4.1*	*22.0*	*23.0*	*
2007 Annual Median		*1.39*	*0.67*	*6.0*	*4.6*	*28.0*	*26.0*	*
2006 Annual Median		*1.44*	*0.84*	*6.0*	*	*24.0*	*23.0*	*
2005 Annual Median		*	*	*	*	*	*	*
2004 Annual Median		*1.31*	*1.00*	*5.5*	*	*28.0*	*23.0*	*

In 2012, sampling at Walton Lake was conducted one to four times per month at two sites from April through October representing a total of 18 samples and observations during 2012. Water quality and categorical measurements were not made during four of the visits that were conducted specifically for the collection of *E. coli* samples in 2012. All

fourteen regular survey events occurred during sunny/clear or partly cloudy days. Surface water conditions were described as being calm or having ripples present on most all occasions, with the exception of the May and July surveys when small waves were present. Water coloration was noted as being varying shades of light brown throughout the year. "Earthy" odors were recorded at both sites from May through August. As noted in previous reports, an abundance of *Chara* mats along the bottom was present in the lake.

The annual median water depth for the monitoring stations on Walton Lake was 1.90 meters, the deepest annual median recorded to date. Monthly median pH values during the year, as well as the annual median for all sites (7.0 units) were all within the 6.0 - 9.0 unit standard range set by VADEQ and were similar to previously reported values. Additionally, no individual pH measurements were outside the VADEQ standard range during 2012. Monthly median surface temperatures ranged from 20.0 to 29.0^{o}C and varied normally with season. As in past years, all individual site temperature values were at or below the VADEQ standard of 32.0^{o}C during 2012. All individual and monthly dissolved oxygen concentrations, as well as the annual median were above VADEQ's 4.0 mg/L limit and were indicative of well-oxygenated waters. The annual median dissolved oxygen concentration value (9.3 mg/L) was the greatest observed since monitoring of this parameter began in 2007.

Fourteen *E. coli* measurements were made at this site during the growing season. Samples were incubated for 48 hours at 21^{o}C with all resulting median densities ranging from <20 to 25 CFU/100ml. The greatest individual density reported was 40 CFU/100ml and none of the samples exceeded the 235 CFU/100ml VADEQ *E. coli* water quality standard for recreational contact in 2012.

Monthly median Secchi disk depths ranged from 0.44 to 0.94 meters with an annual median of 0.64 meters. Secchi disk depths during 2012 were generally lower than observed in past reports with the annual median the lowest observed at this site to day. This observation indicated a slight loss in water clarity within Walton Lake. The annual median Trophic State Index value (67) was the greatest observed to date and continued to suggest that Walton Lake is a biologically productive and mildly eutrophic body of water. Trophic State Index Values in July (72) and August (72) were suggestive of mildly hypereutrophic conditions (index values > 70) during summer. As mentioned in previous reports, further observations on Walton Lake with particular emphasis on the visual assessment of aquatic plant growth and distribution and the extent of algae blooms are warranted. All of the observations at this station continued to suggest excellent water quality within this biologically productive lake.

Discussion

Regular measurements of water quality were made by volunteers at thirty-one stream and river stations and at two lake stations in Chesterfield County. During 2012, there were 408 individual site visits conducted by 45 volunteer monitors, representing a total of 548.3 hours of effort. A summary of these measurements' annual median values is presented below in Table 2.

Table 2. Annual median values of measurements made among thirty-three stream, river and lake sites in Chesterfield County, 2012. Asterisks indicate that no measurements were recorded.

Station	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (°C)	Air Temperature (°C)	*E. Coli* (CFU/100ml)
James River @ Robious Landing	*	≥130.0	7.5	8.8	15.8	18.0	*
Tributary to Falling Creek @ Rockwood Park	0.52	72.0	6.5	6.9	16.3	19.5	*
Tributary to Falling Creek @ Midlothian Mines	*	70.0	6.5	5.1	20.0	19.0	<20
Swift Creek @ Bailey Bridge Road	0.67	≥130.0	6.8	6.7	18.0	21.8	*
Nuttree Branch @ Swift Creek Elementary	0.07	13.0	5.5	2.5	18.0	24.0	*
Spring Run @ Birdsong Lane	*	≥130.0	7.0	7.8	18.0	21.0	180
James River @ Enon Park	1.70	*60.0 (Secchi)*	7.5	9.1	18.5	19.0	140
Tributary to Powhite Creek @ Bon Air Elementary	*	≥130.0	6.5	7.8	15.3	18.8	170
Tributary to Powhite Creek @ Poplar Hollow Trail	0.10	122.5	6.0	9.4	19.3	26.0	<20
Johnson Creek at Kingston Avenue	0.46	107.0	6.0	7.4	17.3	24.0	*
Second Branch @ Bundle Road	*	80.8	5.5	6.2	10.0	19.3	*
Tributary to the James River @ Old Gun Road	*	120.0	7.0	8.0	14.5	21.0	*
Winterpock Creek @ River Road	*	57.0	6.5	4.7	15.8	23.0	<20
Falling Creek @ Belmont Road	1.20	117.5	6.5	6.7	17.0	22.5	*
Falling Creek @ Kay Road	0.63	64.2	6.5	9.9	21.0	22.0	*
Horner's Run @ Fernbrook Park	*	75.0	6.5	8.4	22.5	23.8	*
Tributary to Spring Run @ Forest Row Trail	*	88.0	6.5	7.2	15.0	19.0	*
Swift Creek @ Old Beach Road	*	≥130.0	6.5	9.1	14.3	19.5	*
Great Branch @ Chalkley Road	0.50	61.0	6.0	6.1	15.0	19.0	*
Marine Spring Branch @ Kings Farm Drive	0.13	≥130.0	6.5	8.9	14.0	21.0	55
Timsbury Creek @ Happy Hill Road	*	51.0	6.0	10.8	15.5	20.0	*
Oldtown Creek @ Branders Bridge Road	*	52.0	6.0	10.0	14.8	21.0	*
Otterdale Branch @ Lake Summer Place	*	105.0	6.5	5.8	14.5	18.5	*
Westbranch @ Prescotts Level	*	≥130.0	6.5	6.6	17.9	25.1	*
Tributary to Powhite Creek @ Bloomfield Road	*	56.0	7.0	4.4	18.0	20.0	*
Little Tomahawk Creek @ Midlothian High School	*	105.0	6.0	6.3	19.0	26.0	50
Second Branch @ Nash Road	1.16	55.0	5.0	9.7	17.0	23.0	*
Swift Creek @ Pochohontas State Park	2.70	90.5	6.5	7.5	21.0	25.0	*
Marine Spring Branch @ Knights Run Drive	0.15	≥130.0	7.0	7.8	13.5	16.0	*
Tributary to Michaux Creek @ Lastingham Drive	1.00	≥130.0	6.5	8.6	15.5	19.0	*
Lake Salisbury @ Community Dock	*	54.0	7.5	7.4	11.8	12.8	*
Spring Run at Mockingbird Lane	*	≥130.0	7.0	6.4	14.3	15.8	*
Walton Lake	1.90	*64.0 (Secchi)*	7.0	9.3	25.0	27.5	<20

As in past years, most all annual medians of pH, dissolved oxygen and surface water temperature met Virginia Department of Environmental Quality (VADEQ) surface water standards during 2012. Exceptions to these observations included three annual or monitoring period medians where pH was below 6.0 units and one median where dissolved oxygen was below 4.0 mg/L. Details of these sites and observations are discussed in their respective sections.

pH

Observations of pH indicated that most all measurements made during 2012 fell within the acceptable 6.0 to 9.0 unit range specified by the Virginia Department of Environmental Quality. As noted in previous reports, there were several instances of slightly elevated pH values (8.0 units) during 2012, especially during the summer months at the James River sites (Robious Landing Park and Enon) and at Horner's Run (Fernbrook Park). Similar results were observed from August through October at Lake Salisbury. These observations were most likely due to increased algal activity in these water bodies at these sites. Increased algal activity can influence pH measurements by the removal of carbon dioxide from the water via the process of photosynthesis. This removal can lead to localized decreases in the carbonic acid concentration of the water and thus drive the pH toward the basic end of the scale. As noted in the past two years reports, there were many individual measurements during the course of the year were at the lowermost limit of acceptability (6.0 units), a common occurrence for surface waters in Chesterfield County due to natural conditions. In addition, there were 19 observations of low pH that fell below the VADEQ acceptable range. The majority of these measurements were noted within two stream systems in 2012. At Nuttree Branch (Station 5), there were nine observations of low pH (5.5 units) recorded from September to December. Within two reaches along Second Branch (Stations 13 and 34), six observations ranging from 4.5 to 5.5 units were recorded in April and from August through November. Both of these stream systems are currently on VADEQ's impaired waters list for pH impairments from natural sources. None of the low pH readings observed appeared to be pollution related and while low were not outside of the range of pH values often observed within Chesterfield County. Overall, pH values among all sites were similar to those observed during previous years and indicated acceptable conditions.

Dissolved Oxygen

Dissolved oxygen concentrations indicated adequate to well-oxygenated waters at most all sites during 2012. During the year, there were 31 individual median observations at ten reaches that did not meet the minimum 4.0 mg/L VADEQ standard for adequate oxygen (Table 3). At seven of these sites, the instances of low dissolved oxygen were limited to one or two observations during the year while at three; concentrations were low on three or more occasions.

Table 3. Individual instances of low dissolved oxygen (<4.0 mg/l) recorded among all monitoring stations during 2012.

Station	Station Number	Monitoring Date	Median Dissolved Oxygen (mg/L)
Tributary to Falling Creek @ Midlothian Mines	3	10/03/12	3.7
		11/08/12	2.6
		12/07/12	2.1
Swift Creek @ Bailey Bridge Road	4	07/07/12	3.9
		07/22/12	1.5
Nuttree Branch @ Swift Creek Elementary	5	06/06/12	2.0
		08/21/12	2.1
		08/28/12	1.1
		09/03/12	3.7
		09/11/12	1.4
		09/25/12	1.1
		10/09/12	3.5
		10/16/12	2.5
		10/23/12	0.5
		11/06/12	3.4
		11/20/12	1.4
		12/04/12	2.5
		12/18/12	2.1
Winterpock Creek @ River Road	15	07/11/12	3.1
		08/03/12	3.2
		08/28/12	2.7
		10/03/12	3.0
Horner's Run @ Fernbrook Park	21	08/03/12	3.9
Tributary to Spring Run @ Forest Row Trail	23	11/26/12	3.5
Great Branch @ Chalkley Road	25	04/25/12	3.7
		08/31/12	1.7
Otterdale Branch @ Lake Summer Place	29	06/30/12	3.5
		10/28/12	3.2
Westbranch @ Prescotts Level	30	08/29/12	3.7
Tributary to Powhite Creek @ Bloomfield Road	32	06/18/12	3.9
		07/18/12	3.1

At the Tributary to Falling Creek at Midlothian Mines Park site (Station 3), low dissolved oxygen measurements were recorded on three surveys during 2012 with the low readings ranging from 2.1 to 3.7 mg/L. More pervasive low dissolved oxygen concentrations were observed at Nuttree Branch (Station 5) and at Winterpock Creek (Station 15) during 2012. At Nuttree Branch (Station 5), dissolved oxygen levels frequently were observed below the state standard throughout much of the year. Individual median values of low dissolved oxygen at this site range from a low of 0.5 mg/L recorded on October 23, 2012 to 3.5 mg/L noted on October 9, 2012. In addition, low flow and high turbidity were present at this site with overall observations attributed to drought conditions that persisted through the summer and fall. In addition, this particular segment of Nuttree Branch is currently on VADEQ's impaired waters list for dissolved oxygen impairment from natural sources. For the third consecutive year, a persistent period of low dissolved oxygen was noted at Winterpock Creek (Station 15). At this site, low dissolved oxygen median values ranged from 2.7 mg/L on August 28, 2012 to 3.2 mg/L on August 3, 2012.

As observed in past reports, the low dissolved oxygen was typically present during the summer and early autumn. This section of Winterpock Creek is also on VADEQ's impaired waters list for dissolved oxygen impairment from natural sources.

In general, the majority of the low dissolved oxygen concentrations noted among the site monitored were typically noted during the growing season (April - October), especially in slow moving/sluggish streams when ambient air temperatures were high. As the temperature increases, the ability of the water to hold oxygen diminishes and results in the lower concentrations. Most streams, rivers and lakes have localized areas that possess higher concentrations providing fish and aquatic life a refuge from the lack of oxygen, however if the condition is too widespread, fish kills may occur. The low dissolved oxygen measurements observed in 2012 appeared to be the result of naturally occurring conditions and apparently had little or no affect on aquatic life. With the exception of Nuttree Branch (2.5 mg/L), all annual median values were above the minimum 4.0 mg/L VADEQ standard in 2012.

Temperature

Monthly median temperatures and individual measurements varied normally according to season. There were three events recorded in 2012 where the water temperature equaled or exceeded the state standard of 32.0 degrees Celsius. These events were recorded at the Swift Creek site at Bailey Bridge Road (Station 4) and the Swift Creek site located within Pocahontas State Park (Station 35). At Swift Creek (Station 4), instream temperatures reached 32.0^{o}C on July 7, 2012. At the Swift Creek Station 35, elevated stream temperatures were recorded on June 22, 2012 when the water temperature reached 33.0^{o}C and again on July 27, 2012 when the water temperature was recorded at 32.0^{o}C. In all of these instances, elevated instream temperatures were attributed to concurrent hot ambient air temperatures (37.5 - 42.0^{o}C) and were not related to any water quality concern. The lowest monthly median temperature (3.5^{o}C) occurred at Otterdale Branch during December. Air temperature at all stations varied normally with season during 2012.

Transparency

Water clarity was measured with a 120-centimeter turbidity tube (stream and river stations) or by a standard eight-inch Secchi disk at the James River at Enon Park and the Walton Lake stations. All readings and statistics discussed in this section are expressed as centimeters for comparison purposes. For statistical purposes, field readings recorded above 120 centimeters were expressed as greater than 130 centimeters to account for variations in reporting numbers above the top line of the turbidity tube. The greatest annual median transparencies (≥130.0 centimeters) were observed at ten sites (33%) during 2012. This reporting year was the second consecutive year that excellent water clarity was observed at the Tributary to Powhite Creek at Bon Air Elementary School and at the Marine Spring Branch at Kings Farm Drive stations. In addition, excellent water clarity was observed for the fourth consecutive year at the Swift Creek at the Bailey Bridge Road and Spring Run at Birdsong Lane reaches. The six other stations where excellent clarity was present included the James River at Robious Landing Park, Swift

Creek at Old Beach Road, Westbranch at Prescotts Level, Marine Spring Branch at Knights Run Drive, the Tributary to Michaux Creek at Lastingham Drive and Spring Run at Mockingbird Lane. Substantially reduced clarity was again observed at the Nuttree Branch site where the annual median transparency was calculated as 13.0 centimeters. This station again demonstrated the lowest annual median transparency noted at all sites during 2012. Water clarity is strongly influenced by a variety of factors including abundant plant and algae growth or by suspended fine particulate matter in the stream or lake water column.

E. coli

In 2012, *E. coli* monitoring using the Coliscan Easygel method was conducted at nine sites to characterize ambient bacteria levels. A total of 80 individual measurements at eight stream and river stations and at one lake site were made throughout the year. Samples were incubated at varying temperatures and times ranging from 24 hours at 35^{o}C to 72 hours at 23^{o}C depending on site and were all within the method procedure limits.

The monitoring periods medians observed at these nine stations ranged from <20 CFU/100ml at multiple reaches to 180 CFU/100ml at Spring Run (Station 6) in 2012. While no monitoring period median values were excessive, there were seven individual measurements made at four sites in 2012 that exceeded the 235 CFU/100ml VADEQ *E. coli* water quality standard for recreational contact (Table 4). Of these four sites, only one, the James River at Enon Park, was currently listed on VADEQ's impaired waters list for bacterial impairment and the 2012 findings at this station were considered consistent with its history. Observations of bacterial contamination at the remaining three stations were isolated and had returned to acceptable levels on subsequent surveys. Based on consecutive *E. coli* levels reported at the Marine Spring Branch at Kings Farm Drive site (Station 26), Department of Environmental Engineering – Water Quality Section staff conducted an evaluation of the immediate watershed to rule out sanitary sewer impacts. Results indicated that there were no discharges from the sanitary system and acceptable bacterial levels were observed at this site by October 2012.

Table 4. E. coli *densities observed at four sites in 2012 exceeding VADEQ recreational contact standard of 235 CFU/100ml.*

Station	Station Number	Monitoring Date	*E. coli* (CFU/100ml)
Spring Run @ Birdsong Lane	**6**	**08/03/12**	**320**
James River @ Enon Park	**8**	**05/16/12**	**300**
		06/10/12	**4000**
		11/21/12	**280**
Tributary to Powhite Creek @ Bon Air Elementary	**10**	**06/20/12**	**520**
Marine Spring Branch @ Kings Farm Drive	**26**	**07/09/12**	**540**
		08/10/12	**300**

General Observations

Volunteers made visual observations of water quality and wildlife during each survey. Surveys were conducted the most on clear/sunny (48%) and partly cloudy (28%) days with the remainder occurring on days that were overcast (18%) or with showers or rain present (6%). Approximately 63 percent of visits were conducted during normal "baseflow" or "calm" conditions. Surveys conducted during "high" flow conditions (12%) and "low" flow conditions (20%) accounted for the majority of the remaining site visits. There were 15 instances (4%) of "very low" "negligible" or "dry" conditions noted during 2012, all occurring during periods of dry weather. As noted in 2011, approximately 59 percent of the observations recorded in 2012 indicated a light to dark brown or green color present in the monitored waters. Clear water was reported on approximately 34 percent of visits with the remaining six percent characterized as "turbid". As in past years, odors were infrequently recorded ("none" = 83%) and when noted they were usually described as "earthy" (15%). There were nine instances (approximately 2%) of a "rotten egg" or "sewage" recorded during 2012, most frequently observed at the Nuttree Branch site (Station 5). As in past reports, the most common trash item continued to be litter and leaves/debris from the watersheds. Additionally, algae and pollen were frequently noted on the water surface or within the water column at several sites during 2012. There were several instances of "bubbles" and foam reported in the James River. A variety of wildlife was observed during the year to include numerous aquatic insects, fish, frogs, turtles, songbirds and waterfowl.

Future Goals

The Chesterfield WaterTrends program will continue to grow with an emphasis on maintaining current sites, expanding monitoring coverage, improving communication with monitors and broadening the suite of testing parameters. The WaterTrends program will be supported with the aid of a 2013 Virginia Department of Environmental Quality (VADEQ) Citizen Water Quality Monitoring Grant. The grant will support the purchasing of equipment and the printing of the Chesterfield WaterTrends annual report.

In 2012, Chesterfield WaterTrends will continue to expand its bacterial monitoring and add macroinvertebrate monitoring using the Virginia Save Our Streams Rocky Bottom Method. The program will continue to add bacterial sites with an emphasis on areas with known impairments and bacteria TMDLs.

Chesterfield County WaterTrends Monitors

Much thanks and appreciation is given for the selfless volunteers who brave the elements to acquire data that assists in the protection of Chesterfield County's waters. Their stewardship is commendable.

Station 1	The Isman Family
Station 2	Alex Telez and Elmer DeLa Cruz
Station 3	Jennifer Childress
Station 4	Joe Roussos, Cameron and Harrison Wells
Station 5	Theresa Biagioli
Station 6	Tom and Gretchen Cole
Station 8	Jim Turner
Station 10	C.E. Pond
Station 11	Joel and Margie Dexter
Station 12	Norah Fink
Station 13	Heather Turek
Station 14	The Schlosser Family
Station 15	The Cole Family
Station 18	John Vance
Station 19	J. Haviland and T. Jenkins
Station 21	K.D. Tuley
Station 23	Lucretia Farago
Station 24	Victor Vilchiz
Station 25	Rich Marino
Station 26	Diane Lewis
Stations 27 & 28	The Kester Family
Stations 29 & 30	The Hagan Family
Station 32	Fran Dorman
Station 33	Natalie Walker and Casey McGee
Station 34	Katy Turner
Station 35	Lisa Thompson and Susanna Kirschner
Station 36	Tyler Jutz
Station 37	Tyrone Murray
Station 38	Tyler Anderson
Station 39	Casey Allison
Station 200	Dr. John Burmeister